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THE CALIFORNIA RAISIN INDUSTRY—A STUDY IN GEOGRAPHIC INTERPRETATION

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CRITICAL ASPECTS OF THE INDUSTRY

The rapid rise of the California raisin industry in the last two decades is one of the striking recent developments in American agriculture. The industry now produces more than 90 per cent of the raisins consumed in the United States and approximately 60 per cent of the world's output. Less than sixty years ago the section of California in which the raisins are grown was a remote cattle country, an outpost on the American frontier; less than twenty years ago, although devoted to raisin culture, it rated as a relatively unsuccessful agricultural district, and the permanency of the industry was in question. In the last decade, however, the industry has ranked among the leading agricultural industries of California, and the raisin district among the more prosperous agricultural sections of the country. The virility of the industry is demonstrated by the fact that it weathered the period of economic readjustment since the war without a notable abatement of prosperity. The vigorous growth of the raisin industry in the brief span of fifty years becomes particularly notable when it is realized that it has been developed by a rather diverse social group drawn for the most part from eastern United States and northwestern Europe and, therefore, equipped with little or no knowledge of this highly specialized product of Mediterranean agriculture.

Raisin production in the United States is localized in the middle section of the San Joaquin Valley. This localization is indicated in the accompanying figure 1 showing the distribution of the acreage of raisins in 1922. Approximately 87 per cent of the total acreage and more than 90 per cent of the total production is in Fresno, Tulare, Kings, and Madera Counties, and 60 per cent of the acreage and at least 75 per cent of the production is in Fresno County. In fact in 1921 the production in Fresno County represented 81 per cent of the total.¹ Within these counties the raisin vineyards spread over the irrigated middle slope of the piedmont alluvial plain which fronts the Sierra Nevada Mountains and which occupies approximately the eastern two-thirds of the floor of the San Joaquin Valley. The principal district centers at the city of Fresno and extends along the longitudinal trend of the valley for a distance of about 90 miles. The width of the district varies from 20 to 40 miles (Fig. 1). Outside of this district there are small outposts in Kern, Merced, and Stanislaus Counties in the San Joaquin Valley and in Yolo and Yuba Counties in the middle section of the Sacramento Valley.

¹ Status of California Grape Industry, *Calif. Dept. of Agric., Spec. Pub. No. 28*, pp. 13, 34-5.

Grape culture in general in California extends over a much larger area than that occupied by the raisin grape. In fact, the raisin grape district is but one of the principal three vineyard districts. Table

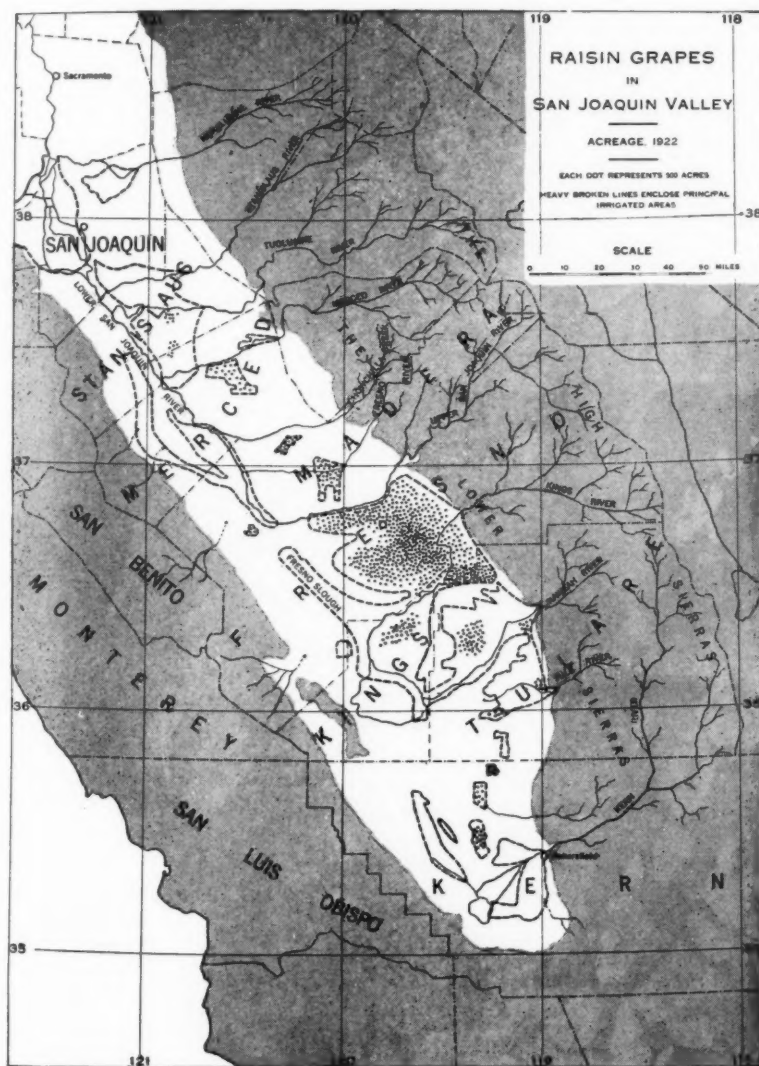


FIG. 1. Distribution of raisin grape vineyards in San Joaquin Valley.

grape culture centers in the Sacramento Valley, while the juice (wine) grapes flourish in the coastal valleys about San Francisco Bay. The distinct localization of each type of grape culture is related closely to the natural environment, as will be explained subsequently. However, some raisins are produced in the Sacramento Valley, and considerable amounts of table and juice grapes are shipped from the San Joaquin Valley. In addition to these major districts, there is a table and juice grape district in the San Bernardino piedmont and in the El Cajon Valley in San Diego County.

The raisin district is not only a pleasant countryside, but a vigorous, progressive, and highly specialized agricultural area. Broad acreages



FIG. 2. A landscape in the Fresno Raisin District. The cultural landscape of broad vineyards, secondary tree crops, and closely spaced homesteads represents a regional capitalization of the well drained, even surface, uniform slope, and the fertile, easily tilled soils of this broad, arid piedmont alluvial plain. (Photographs from Laval Co.)

of vineyards broken by smaller acreages of peaches, figs, and other crops and by trees about the farm homes and along some of the irrigation ditches make up the agricultural landscape (Fig. 2). On clear days the levelness of this broad piedmont is relieved by the irregular skyline of the distant Sierras. The homes of the growers are closely spaced, for, although large ranches are not uncommon, the typical raisin ranch is from 20 to 50 acres in size. Most of the farm homes are built near the roads, which for the most part follow the section lines or divide the sections (Fig. 3). This square road pattern reflects the broad area

and level surface of the piedmont alluvial plain. The villages and towns, which serve as the centers of these raisin grape communities, or colonies as originally they were called, are spaced at distances of from 3 to 10 miles along the railroads which follow the longitudinal trend of the valley. In general, these community centers are more widely spaced down the slope of the piedmont plain than they are across it. Farm buildings and equipment are modern. Good roads, automobiles, the telephone, excellent schools and school buildings bespeak an agricultural community with a high standard of living, with unusual rural social opportunities, and with an optimistic economic outlook.



FIG. 3. A section of the Reedley California Quadrangle (2 in. to the mile). The small size of the land holdings characteristic of the raisin districts is reflected in the close spacing of farm homes along the roads. Water is not diverted from Kings River (at the left) in this part of its course because it is deeply entrenched in the plain. Water in the irrigation ditches, emphasized on this map by heavy single lines, is diverted about 15 miles up stream where the river is not entrenched in the plain.

Land values in the raisin district are high, and operating expenses large. The average value of all farm property per farm in Fresno County in 1920 was \$33,991, which of course includes the several types of farms in this large county. Typical raisin ranches involve a capital investment considerably above this figure. It is difficult to generalize on the value of a producing vineyard per acre, for the sale price of a vineyard varies from place to place and from time to time, but apparently the range is from \$500 to \$1,500. Raw land is of course much lower in price, but as it requires three or four

years for a vineyard to come into bearing, prospective growers must be able to command considerable financial backing. Most of the ranches are operated by the owners; in fact, 7,291 of the 8,917 farms in Fresno County in 1920, were operated by owners. This is a fortunate condition because the management of a raisin vineyard requires considerable specialized knowledge on the part of the grower.

Raisin grape culture was introduced into the San Joaquin Valley in 1873, developed rapidly between 1880 and 1890 and then for more than two decades made relatively little advance. In the fourteen-year period since 1912, however, the industry has progressed greatly, the acreage of 1922 being four times that of 1913 and the production of 1924 being 2.8 times that of 1912. Paralleling this growing production, there has been a notable increase in raisin consumption in the United States and Canada. Moreover California raisins are now competing successfully with Mediterranean raisins in their time-honored market in England and other countries of northwest Europe and are being sold in small but increasing quantities in China, Japan and other markets. The expansion of the industry during this period has been characterized by and, in part, occasioned by the successful adoption of the principles of coöperative marketing. The prosperity which followed the introduction of coöperative marketing was stimulated by the high price for raisins which prevailed in the years immediately following the war. As a result, the acreage planted to raisin grapes increased so greatly that in 1922 it was estimated that the production of raisins in California would double in the four years from 1922 to 1926.² The marketing of such an increased production presents a grave problem to the growers' organization, and on its successful solution depends the continued prosperity of the industry. However, the history of the industry demonstrates that the growers have been notably successful in solving the series of problems which have confronted them. In view of these facts and of the present depression in many agricultural industries, it appears appropriate to bring the progress of the raisin industry into question. The present analysis proceeds according to the four striking aspects of the industry which briefly have been mentioned. These are (1) the development of raisin grape culture on a commercial basis in a pioneer area by a people whose agricultural background did not include its culture, (2) the notable localization of the crop in the middle San Joaquin Valley, (3) the utilization of cultural practices which adjust the crop to the natural environment in which it is grown, and (4) the successful application of the principles of coöperative marketing to the industry.

² Status of California Grape Industry, *op. cit.*, p. 37.

PART I. THE DEVELOPMENT OF RAISIN CULTURE ON A COMMERCIAL BASIS BY A PIONEER GROUP PREVIOUSLY UNACQUAINTED WITH THE PRODUCTION OF THE CROP

Introduction of Viticulture into California.—An explanation of the development of raisin grape culture on a commercial basis by the agriculturists who settled California in the early decades following the discovery of gold in that state, carries back to the introduction of viticulture into California by Spanish missionaries. These missionaries brought the Mediterranean type of grape to their San Diego Mission in 1769.³ Subsequently, its culture spread to the other missions, and thus more than a century of pioneer cultivation preceded the development of the raisin industry. This was fortunate, because the Mediterranean grape is a highly specialized vine. Through centuries of careful cultivation, it has been developed into an agricultural aristocrat demanding from the natural environment a combination of climate, water resources, and soil, occurring in but few places in the world, and from the grower, a thorough mastery of the practices and even the science of viticulture. The history of raisin grape culture demonstrates that the precise environment for the vineyards has been discovered only by prolonged exploration and experimentation, and that the proper methods and practices required for its culture are learned only after years of experience. It is a matter of no mean significance to the present status of agriculture in California that this region, in which in a number of ways the natural environment closely resembles that of the Mediterranean, was settled by the Spanish missionaries. These able representatives of Mediterranean culture introduced crops and practices which, after the gold rush in 1849, were capitalized by the ranchers who settled the state.

Although the flocks and herds which flourished on the native pastures constituted the major economic interest of the Spanish missionaries, vineyards, orchards, gardens, and grain fields were developed in the moist river valleys near the missions. The work of cultivating the crops was done by Indians under the direction of the missionaries, so that at best the methods were crude and the amount of labor expended in cultivating the crops small. The vineyards and orchards thrived in spite of cultivation rather than because of it. At San Gabriel, from 400 to 600 barrels of wine and 200 barrels of brandy were made annually and in some years the sales of such liquors to rancheros and to the occasional ship calling at the harbor for hides and skins aggreg-

³ Husmann, Geo. C.: Grape Raisin and Wine Production in the United States, Yearbook, Dept. of Agric., 1902, p. 407.

gated approximately \$12,000.⁴ At times in the autumn, raisins were made from the grapes. Upon occasion the grapes grown near the coasts had to be carried into the back country to be cured, because the fogs and greater humidity of the air near the coasts prevented the grapes from curing satisfactorily.

The grape grown was the so-called "Mission" grape which was brought from vineyards in Mexico. Grape culture had been introduced into Mexico as early as 1520,⁵ and it is probable that vineyards existed about Mexico City and at many of the Mexican missions. However, the stock had deteriorated in quality⁶ both because of the fact that the climate of the plateaus of Mexico with its summer rain and cool nights was unsuited to its culture, and because apparently little attention was given to proper methods of cultivation.⁷ Geographically, it is significant to picture the slow migration of the Mediterranean grape from mission to mission in Mexico—through an environment so unsuited to its culture that it deteriorated greatly in quality. Finally it reached California the climate of which practically reproduces that of the original home of this grape. Once introduced into this environment, the vine flourished and became an asset for subsequent exploitation.

Following the example of the missions, small vineyards were set out at a number of ranches. In 1831 there were 100 acres of vines in the area now included in the city of Los Angeles, and by 1848 small vineyards existed at Santa Barbara, Santa Clara, and other points along the coast and in a few places in the Sacramento Valley.⁸ Colonel Sutter, whose workmen made the epochal discovery of gold in the valley of the American River, maintained a vineyard and a wine vat and cellar on his ranch near Sacramento. The contribution which these pioneer vineyards made to the viticultural industry was that they established the European grape in California before 1849. This made it possible for grape culture to be one of the agricultural pursuits which were stimulated by the active market for farm products in California following the discovery of gold.⁹ The part which wine and other liquors played in this picturesque period of California history is well known. Such wines as could be made sold at high prices. Probably a considerable part of the 57,355 gallons of wine made at

⁴ Hittell, T. H.: *History of California* (San Francisco, 1885), II, p. 474.

⁵ Husmann, op. cit., p. 7.

⁶ Bancroft, H. H.: *History of California* (San Francisco, 1890), VII, p. 44.

⁷ Hittell, op. cit., p. 474.

⁸ Bancroft, op. cit., p. 46.

⁹ Nordhoff, C.: *California* (New York, 1874), p. 216.

Los Angeles in 1850 was consumed in the mining camps and centers.¹⁰ The *Sacramento Transcript* for October 14, 1850, states that one grower expected to clear \$25,000 from his small vineyard.¹¹ To appreciate the extent to which this local demand for wine stimulated grape culture, the remoteness of California from the world's markets in 1849 must be recalled. Connected as they were with eastern United States and Mexico only by tedious and difficult desert and mountain trails or by long overseas voyages, the few settlements in the state were at that time one of the truly remote sections of the world. This remoteness, growing out of the position of California on the Pacific slope of the continent, has throughout the history of the state been one of the conditions of the natural environment to which industrial development in the state has been related. How the raisin industry through its marketing organization adjusted itself to this condition will be presented subsequently.

Experimental Stage of Viticulture.—The interest in grape culture stimulated by the demand for wine after 1850 resulted in the planting of a number of vineyards and in the importation of new and choicer vineyard stock from Spain, the Crimea, and Hungary.¹² During ensuing years, upwards of 500 varieties were imported from the different European countries famous for their wines.¹³ Many of these were of little or no value to the wine growers of California because they were not adapted to local climatic, drainage, and soil conditions. The summer rain and sharply defined growing season of central France, the Rhine Valley, and Hungary find little counterpart in California. These early importations were made principally by vineyardists in the coastal valleys, which was fortunate, as these valleys possess a comparatively wide range of soils and weather conditions. In many places in these valleys grapes can be grown without irrigation, so that the development of viticulture was not delayed unduly by the necessity of completing irrigation projects before vineyards were planted. It was in 1852, near the beginning of this experimental period, when search was being made for choicer wine grapes and when wine grape culture was becoming localized near San Francisco Bay and in southern California, that the Muscat grape, the basic variety in the raisin grape industry, was imported from the Malaga district in Spain.¹⁴ It is a striking fact that of the numerous varieties of Mediterranean

¹⁰ Census of 1850.

¹¹ Bancroft, loc. cit.

¹² Eisen, Gustav: *The Raisin Industry* (San Francisco, 1890), p. 38.

¹³ Bancroft, op. cit., p. 47.

¹⁴ Husmann, op. cit., p. 413.

grapes less than a dozen cure into satisfactory commercial raisins. In California today two varieties, the Muscat and the Thompson Seedless (Sultanina) occupy approximately 80 per cent of the raisin grape acreage, and only four other varieties are listed in the official reports of the Sun-Maid Growers.¹⁵ Apparently all of these originated in the raisin-producing sections of the Mediterranean. While wine and table grape culture flourishes in many European countries, raisins are produced in but a few small Mediterranean districts, principal among which are the Malaga district on the south coast of Spain, the Valencia district on the east coast of that country, and the Smyrna district on the western coast of Asia Minor. The last named is an historic seat of raisin culture, and from it raisins were introduced into northern Europe by the returning crusaders in the eleventh century.¹⁶ These districts, with a few others, apparently comprise the only Mediterranean areas which possess the particular environmental combination necessary for raisin production on a commercial basis.

Although raisin grape varieties were planted in a number of places near the coast, raisin production did not become of particular significance until raisin grapes were planted in the Sacramento Valley. The air along the coast is much too humid for the raisin grapes either to ripen or to cure properly. It is not surprising, therefore, that the first successful vineyards in California were located at Davisville and Woodland, in Yolo County,¹⁷ which places are far enough north and west in the Sacramento Valley to be in the lee of the coastal ranges and thus have a hotter and drier summer than the coastal situations. Although the total crop of raisins and dried grapes for 1866 was estimated at about 40 tons and one writer states that "From present appearances, it seems probable that California will be enabled to supply the entire Union with raisins before the close of the present century,"¹⁸ Husmann and other writers place the beginning of the raisin industry in 1873, when 6,000 boxes were sold.¹⁹ Perhaps in another way that date more truly marks the beginning of the industry, for in that year the planting of a 25 acre vineyard of the Muscat variety near Fresno²⁰ introduced the raisin grape into the one district in all California in which the natural environment is most suited to its culture.

¹⁵ Status of California Grape Industry, op cit., pp. 34-5.

¹⁶ Eisen, op. cit., p. 11.

¹⁷ Husmann, op. cit., p. 413.

¹⁸ Dunn, H. D.: California—Her Agricultural Resources, *Rept. of the Commissioner of Agric. for the year 1866* (Washington, 1867), p. 595.

¹⁹ Husmann, op. cit., 413.

²⁰ Eisen, op. cit., p. 38.

PART II. LOCALIZATION OF RAISIN PRODUCTION

Decline in Southern California.—When it was demonstrated in the early seventies that California raisins could be marketed, raisin grape vineyards were set out in a number of places in the state. In addition to the raisin grape vineyards in the Sacramento Valley and at Fresno, the Muscat variety was planted at Riverside and in the El Cajon Valley near San Diego in 1873 and about the same time in Orange, Los Angeles and San Bernardino Counties.²¹ Wine grapes long had been an important crop at Los Angeles, and experiments in grape culture had been tried there as well as in the valleys near San Francisco Bay.²² Orange County fronts the coast, and the vineyards were from 8 to 12 miles from the ocean, in which respect they resembled the Malaga and Smyrna districts in the Mediterranean region.²³ In Orange County the acreage rapidly increased, and subsequently one of the men interested in the industry became for a time the largest packer and dealer in the state.²⁴ However, by 1890 when the Fresno District had become the leading district, the production in Orange County was of little importance. This was due (1) to an increasing interest in citrus fruits and other crops admirably adapted to conditions in this county, (2) to the ravages of vine diseases which prevailed in this county in the years preceding 1890, where it is argued that the damage from such diseases is greater than in the greater aridity of the interior situations, and (3) to the fact that the grapes ripen late and in some years do not cure well in the humidity which prevails near the ocean.²⁵ Eisen states that at times the grapes, when curing on the trays, were covered with canvas to protect them from fog and dew, and that in two years grapes were carried to the Mohave Desert to be dried. He also points out that in some instances the curing of the raisins was hastened by the extremely low humidity which prevails during the period of a Santa Ana.²⁶ In the El Cajon Valley grapes are grown in some situations without irrigation, but the valley is so small in size and so remote from other raisin sections that it has never been of much consequence in raisin production.

In Riverside and San Bernardino Counties the production of raisins during the eighties rivaled that in the Fresno District. In these

²¹ Husmann, op. cit., p. 413; Eisen, op. cit., p. 39.

²² Bancroft, op. cit., p. 46; Coman, Katharine: *Economic Beginnings of the Far West* (New York, 1912), II, p. 304.

²³ Eisen, op. cit., p. 52.

²⁴ Husmann, op. cit., p. 413.

²⁵ Eisen, op. cit., pp. 52-3.

²⁶ Ibid.

counties the vineyards occupy the piedmont positions about midway between the foothills and the valley bottoms. In general the vineyards are placed lower on the piedmont slope than the citrus fruits. This arrangement places the latter, which do not prosper under frosts, in the position on the slope where frosts are absent or infrequent, and the former, to which frosts are said to be essential, in the positions where frosts occur in most winters. After 1890 the production of raisins in these counties declined. In 1921 the estimated raisin production in San Bernardino County was only 8 tons.²⁷ The decline in raisin production in that county was due to the low price for raisins and to the unstable condition of the raisin market which continued for many years after 1890, to a shift to wine and later table grape varieties to which the district is suited, to an increasing interest in citrus and other fruits, and to the climatic conditions which, although not to the same degree, handicapped raisin culture in Orange County.

Localization in the Fresno District of the San Joaquin Valley.—Experience has demonstrated that, in the long run, raisins are produced more satisfactorily in the middle and upper San Joaquin Valley than elsewhere in California and that, primarily, this is due to the aridity which prevails during the summer and early autumn in this interior valley. Furthermore, the raisin industry is definitely localized into a small fraction of the total area in the San Joaquin Valley which possess the essential climatic conditions for raisin production. This striking localization of the industry in the Central or Fresno District has come about through the gradual capitalization of several assets of both the social and the natural environment of that district. While it must be understood that the localization of the industry is in large measure an expression of its relation to the sum total of these aspects—in other words, to the environmental complex—for convenience of presentation it appears wise to present each relationship in turn. Probably the most fundamental of these relationships which differentiates the Fresno District from other districts in the San Joaquin Valley is that of the utilization of the water resources of the district for irrigating the vineyards.

(1) *Relation to Physical Aspects of Irrigation from Streams.*—Practically all of the raisin grapes in California are grown on irrigated lands. The vines require an abundant supply of water during the spring and early summer, which in this region of summer drought can be supplied only by irrigation. However, raisin grapes are not grown on all of the irrigated lands in the valley, either because these

²⁷ Statistical Dept., Sun-Maid Raisin Growers, June 5, 1922, quoted in *Calif. Dept. of Agric., Spec. Pub. No. 28*, p. 13.

areas long have been devoted to other crops or are not suited to vineyards.

The distribution of the raisin grape acreage in the San Joaquin Valley is shown in the accompanying figure 1. In general the vineyards occupy the east side of the valley between the foothills of the Sierras and the trough of the valley. The position of the latter is indicated by Tulare Basin, Fresno Slough, and the lower San Joaquin River. The general position of the vineyards on the eastern rather than on the western side of the valley is due to the utilization of the large and relatively regular run-off from the rainy elevated Sierras in contrast to that from the ephemeral streams which originate in the low coastal ranges. The absence of vineyards in the irrigated areas in the trough of the valley is due to the fact that vineyards will not flourish in situations in which the ground table is as near the surface as it is at most points in this part of the valley. Moreover, the grassy meadows which characterize the overflow lands in the valley trough were taken up by cattlemen before the evolution of the raisin industry and they have been loath to shift from stock raising to agriculture (Fig. 4). Consequently, at present much of the irrigated land



FIG. 4. Grazing on the broad grass lands of Fresno Slough. Irrigation to improve the pastures and to grow alfalfa is practiced. The ground water table is too near the surface for vineyards.

in this part of the valley is devoted to alfalfa and other fodder crops.

The accompanying figure 1 shows that the several raisin districts in the San Joaquin Valley are spaced at intervals along a longitudinal belt which occupies a position on the piedmont alluvial plain about half way between the foothills of the Sierra Nevada Mountains and the trough of the San Joaquin Valley. It shows also a distinct localization of raisin grape culture in a central district in Fresno County and in neighboring sections of Kings, Tulare, and Madera counties. Most of this central district is irrigated by water diverted from Kings River or from wells driven into its alluvial fan. Two-thirds, at least, of the raisin acreage in the state is irrigated by water from Kings River. Moreover, the area irrigated from this river is the largest area irrigated from one stream in the state.²⁸ The large area irrigated by water from Kings River and, in part, the localization of the raisin industry in it are due to the fact that in no other area in the San Joaquin Valley can water from a stream of large and relatively steady flow be diverted upon the middle piedmont slopes as easily and as cheaply as it can be from Kings River. The explanation of this phenomenon is revealed by a comparison of the problems connected with the utilization of the water from the several rivers which flow into the San Joaquin Valley from the Sierra Nevada Mountains. This explanation resolves into a comparison (a) of the volume and flow of Kings and other major rivers with the minor rivers, and (b) of Kings River with the other major streams.

(a) *Utilization of major versus minor streams.*—The streams which drain the western flank of the Sierras divide into two groups, i. e., major streams like Kings River which head far back in the high Sierras, and minor streams which drain only the lower and foothill sections of this highland. The major streams flowing into the San Joaquin Valley are Kern, Kings, Upper San Joaquin, Merced, Tuolumne, Stanislaus, and Mokelumne rivers. These streams have a greater volume and a more regular flow than the minor streams because of their larger drainage basins and because their head streams spring from the high Sierras where the precipitation is greatest. Thus Kings River drains an area of 1,742 square miles, more than half of which is in the high Sierras.²⁹ Its head streams spread fan-like into the Sierras, draining the summit range for a distance of 70 miles (Fig. 1). Although it does not have as large a drainage basin as Kern River to the south, it has a greater volume because the precipitation

²⁸ Cone, V. M.: Irrigation in the San Joaquin Valley, California, U. S. Dept. of Agric., Office of Exp't Sta's., Bull. 239, p. 32.

²⁹ Ibid.

in the Sierras increases from south to north. The Tuolumne River still farther north carries a greater volume than Kings River, although its drainage basin is smaller than the latter. The flow of these major streams continues large through the spring and early summer months because the precipitation in the high Sierras where these streams head comes principally in the form of snow. This snow accumulates many feet deep in the forests and Alpine meadows of the plateau backbone of the Sierras, and upon the slopes of the jagged peaks which rise



FIG. 5. Winter scene in the High Sierras. The only rivers which furnish water for midsummer irrigation are those which head in these snow-mantled highlands.

above it (Fig. 5). It melts slowly in the spring and, as shown for Kings River in the accompanying figure 6, gives the rivers their maximum flow from April to July at precisely the time when the vineyards must be irrigated. After July the crop would be damaged rather than helped by irrigation. Moreover, the water in these snow-fed rivers is remarkably pure, which is a great advantage to the vineyards, for the raisin grape does not prosper in soils charged with even a small percentage of alkali.

The flow of the minor streams, of which Kaweah, Tule and Fresno Rivers and Calaveras, Mariposa, and Chowchilla Creeks are the more important, is not suited to irrigating vineyards and other crops which

require irrigation in summer. The flow of these torrential streams is difficult to control because much of the precipitation in their basins falls as rain and because the run-off from the crystalline slopes of the maturely dissected western margin of the Lower Sierras is rapid. Moreover the flow varies greatly from year to year and, as the accompanying chart of the flow of Fresno River (Fig. 7) indicates, ends too early in the season for crops which require irrigation in June and

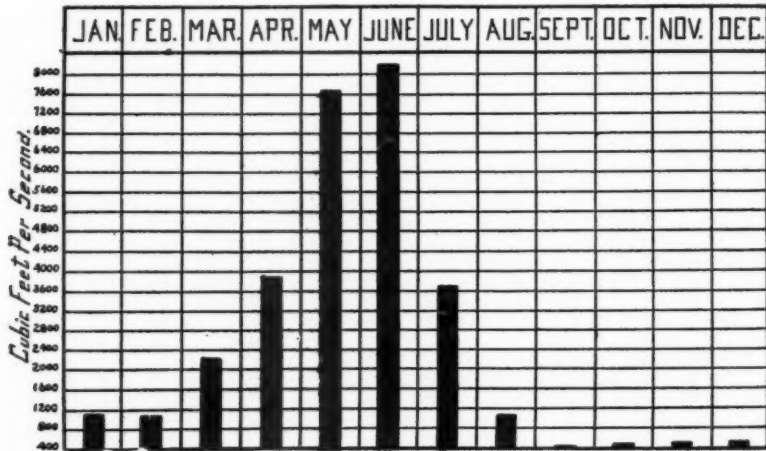


FIG. 6. Average monthly discharge of Kings River. (From V. M. Cone.)

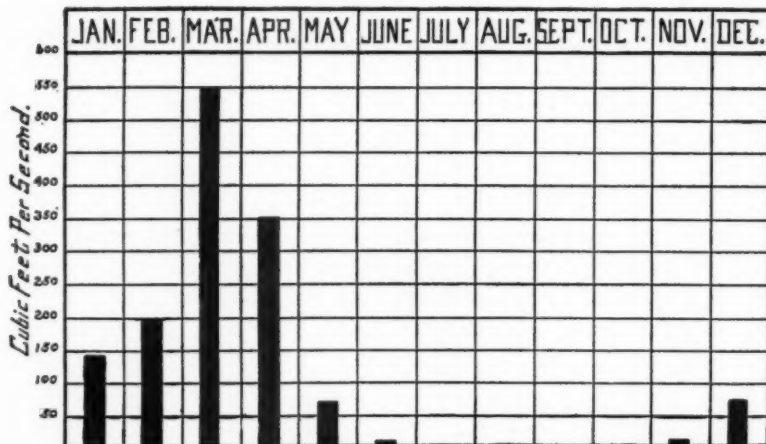


FIG. 7. Average monthly discharge of Fresno River. (From V. M. Cone.)

July.³⁰ Therefore, in the areas irrigated by water from these minor streams cultivation of vine and tree crops in most instances is limited to sites where it is practicable to supplement the water from the streams by water from wells or to sites where all the water used comes from underground sources. Thus, although the flow of Kaweah and Tule Rivers continues later than that of Fresno River, most of the vineyards on these alluvial fans are irrigated by pumping. These vineyards must compete with those in the Kings River District where water is supplied by gravity flow at a much lower cost than by pumping. Moreover, any notable expansion of vineyard acreage in these minor districts is not probable because the water table shows evidences of being lowered by the amount of pumping now being done. Grain and forage crops grown in these districts are produced with early season irrigation, the acreage irrigated varying in direct ratio to the run-off. Such expansion and contraction of cultivation is practicable with such crops, but is entirely unsuited to vine and tree crops.³¹ Thus, up to the present, any considerable development of vineyards in these areas has been impracticable in spite of the fact that they have the climatic conditions suited to raisin production. It is probable that, eventually, an adjustment to the torrential and early season flow of these streams will be made by building storage dams to control their flow. However, up to the present, such projects as have been advocated, have not been constructed, in part because of their expense, and also because of conflicting claims over water rights.³²

(b) *Utilization of Kings River versus other major streams.*—The preceding discussion has demonstrated that the raisin grape is not adapted to the conditions of irrigation which maintain in the trough of the San Joaquin Valley and only in a limited extent to those on the alluvial fans of the minor streams. On the contrary it is adapted particularly well to adequately drained areas irrigated by water from any of the major streams. In furnishing this combination of adequate drainage and abundant water the Kings River District has a decided advantage over the others. The reason is that although the ground water table lies sufficiently low for raisin grape culture in the middle and upper slopes of the alluvial fans of any of these streams, the practicability of diverting water to such position varies notably. The San Joaquin Valley divides into two hydrographic basins, the Tulare Basin

³⁰ Cone, op. cit., pp. 25-7, 43-5, 55, 58.

³¹ Ibid.

³² *Report of the Conservation Commission of the State of California, Jan. 1, 1913*, pp. 199-201, 214-15; Mead, Elwood, and others: *Report of Irrigation Investigations in California, U. S. Dept. of Agric. Office of Exp't. Sta's., Bull. 100*, pp. 225-26.

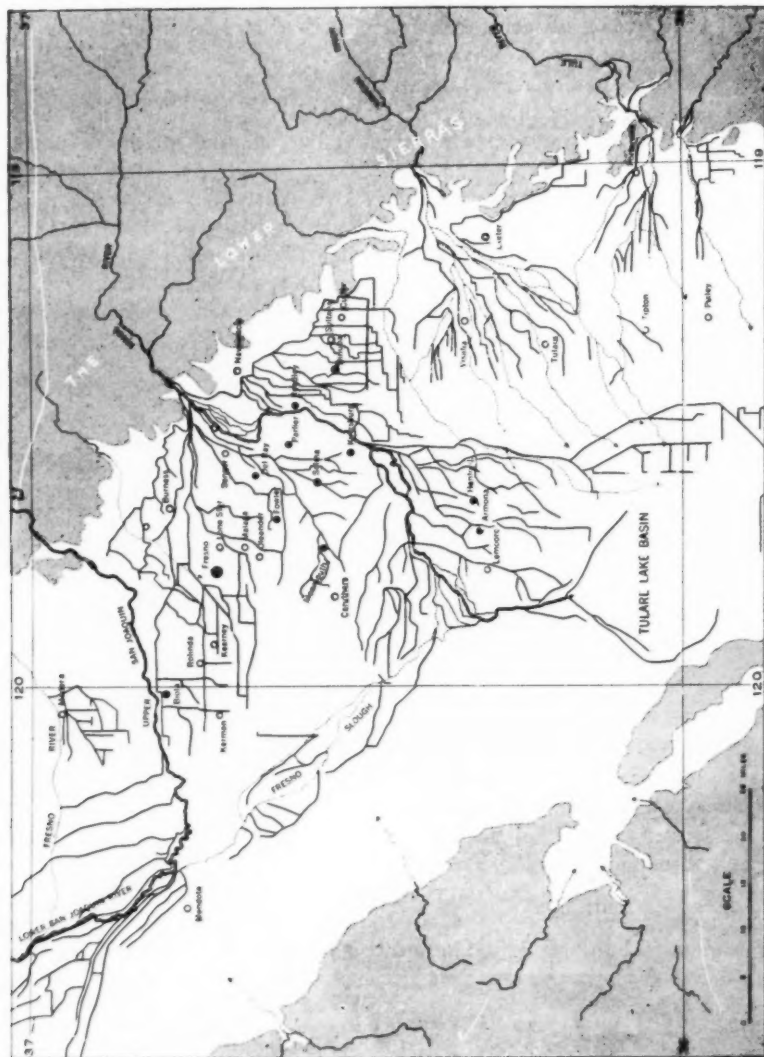


FIG. 8. Irrigation ditches and marketing centres in the Central or Fresno Raisin District. Solid circles show packing plants and open circles receiving stations maintained in the Central District by the Sun-Maid Raisin Growers Association.

in the upper part and the San Joaquin Basin in the lower part. These basins are separated by a low water-laid divide built by Kings River from the east and the much smaller fan of Los Gatos Creek from the west. Kern, Tule, Kaweah, and Kings rivers, which debouche into Tulare Basin, enter the valley from their Sierra canyons in remarkably shallow channels. On the contrary the San Joaquin, Merced, Tuolumne, and other streams which drain into the San Joaquin Basin are deeply trenched in the piedmont plain for many miles beyond the foot-



FIG. 9. Diversion dam in Kings River owned jointly by the Fresno Irrigation and the Consolidated Irrigation districts. Its position is indicated by the arrow on figure 10.

hills of the mountains.³³ As a result, it is a much simpler and less expensive task to divert water to the upper and middle piedmont positions from the streams draining into the upper basin than from those draining into the lower. The contrast between Kings River and the Upper San Joaquin River illustrates the matter concretely.

³³ Hilgard points out this contrast in his survey, as did Mead and his associates; many others apparently failed to recognize its significance. Hilgard, E. W.: Rep't. on the Physical and Agricultural Features of the State of California, *Tenth Census of the United States*, VI, p. 681; Mead, and others, *op. cit.*, pp. 218-9.

For a distance of approximately nine miles from the point where Kings River leaves its canyon in the mountains, its valley floor broadens greatly and lies only from 10 to 20 feet below the general surface of the piedmont plain. In this reach of the valley, locally called the Centerville Bottoms, the river breaks into a number of channels and sloughs from which water is diverted by means of low cobblestone and brush dams. The position of the Centerville Bottoms in the area is

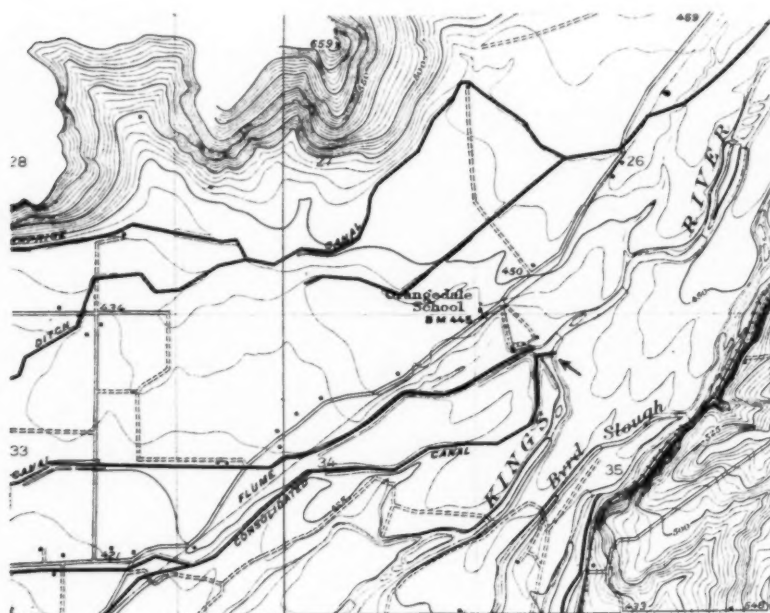


FIG. 10. Section of the Orangedale School Quadrangle showing the shallow nature of the valley of Kings River at the point where it leaves the mountains and enters the piedmont. The gradient of the river and the slope of the plain in this reach of the river are practically the same, consequently, shallow dams suffice to divert water from the river into gravity canals leading to the upper and middle slopes of the piedmont plain.

shown by the braided section of Kings River between Sanger and Navelencia on the accompanying figure 8; the shallow dam which diverts water into the Fresno and Consolidated canals and the low banks of the river are shown in figure 9; while the position of this dam at the upper end of the Centerville Bottoms is shown in figure 10. As the gradient of the stream through these bottoms is only slightly

greater than the general slope of the plain, a few main ditches of simple construction (Fig. 10) carry the water by gravity from the valley to the piedmont plain, over which it is spread by numerous laterals (Fig. 11). In some places the canals follow natural water courses on the plain, thus saving the expense of excavation.³⁴ The water from these diversions is used to irrigate much of the area between the Kings and the Joaquin rivers in Fresno County and a large area



FIG. 11. The upper slope of the piedmont plain near Clovis in Fresno County. That water can be diverted from Kings River to the middle and upper slopes of its alluvial fan is a major reason for the notable development of raisin and other fruit crops in this area. The crop is a newly planted fig orchard. The Sierras show in the background.

on the south side of the Kings River in Tulare County. It will be noticed (Fig. 8) that the canals extend almost to the valley of the San Joaquin River. Near Reedley (Figs. 8 and 3) the valley of Kings River narrows, and for a distance of 10 or 12 miles this river is entrenched in a narrow valley from which diversions are not practicable. Below Kingsbury, as the river approaches the trough of the main valley, its valley broadens and shallows and it breaks into a number of channels from which a number of irrigation canals lead. Except

³⁴ Mead and others, *op. cit.*, p. 287.

in the vicinity of Hanford, Armona, and Lemoore, the water diverted by these canals is not used for vineyards, as in most places the ground water table is too high.

As little or no water is diverted from the San Joaquin River except from the sections of the river lying in or near the valley trough,³⁵ few if any vineyards are irrigated by its water. This is due largely to the fact that it flows in a narrow valley for 40 miles after it leaves

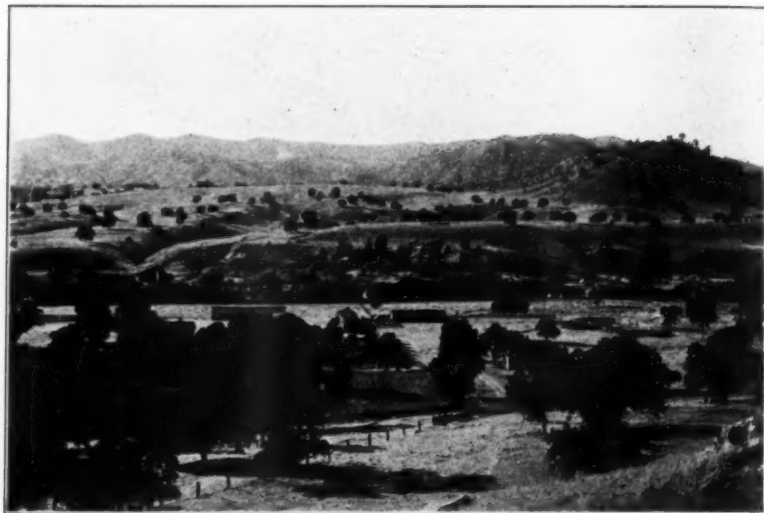


FIG. 12. The valley of the San Joaquin in the foothill reach where the river leaves the mountains and enters the piedmont. The San Joaquin flows in a valley of this character for many miles through the piedmont plain, and therefore diversion of water from the river to the plain has been impracticable up to the present. Conflicting claims over water-rights have militated against the development of the costly dams and ditches necessary to divert water from this river to the middle piedmont slopes. The view overlooks the site of old Fort Millerton.

the mountains, its bed in this section lying from 40 to 75 feet below the surface of the piedmont plain (Fig. 12).³⁶ As a result it has been impracticable to divert water from this river to the middle positions of the piedmont slope. Water from the San Joaquin is diverted in the trough of the valley and is used principally to irrigate pasture, alfalfa, and other forage crops. Thus between the San Joaquin and

³⁵ Grunsky, C. E.: *Irrigation near Merced, California, U. S. G. S. Water-Supply and Irrigation Papers, No. 19*, p. 9.

³⁶ *Irrigation Investigations in California*, op. cit., p. 219.

Merced rivers little irrigation of the piedmont plain occurs except for small developments along the minor streams and where ground water is pumped. In consequence, the culture of raisin grapes is reduced to small amounts in this portion of the valley climatically suited to the crop. The same conditions maintain to a lesser extent along the Merced, Tuolumne, and Stanislaus rivers. Although water is diverted from those rivers near their exits from the mountains, it is carried in ditches for many miles down-slope before being utilized.³⁷ Moreover, these irrigated districts developed later than the Fresno district and on the whole do not possess as favorable weather for the cultivation of the raisin grape.

In the case of the Kern River in the extreme southern part of the San Joaquin Valley, the climate is satisfactory, the flow of the river continues through July, diversion is relatively inexpensive, but its water was appropriated at an early date by large land owners whose principal interests are livestock and grain. These large estates have not been divided into the small parcels essential to the intensive operations required in raisin culture.

In the northern part of the San Joaquin Valley, irrigation and fruit culture on the middle and upper piedmont slopes began much later than in the area irrigated from Kings River. This delay was due to the fact that in the former, stock-raising and large-scale wheat ranching became more widespread and more firmly established, water for irrigation was much more difficult and expensive to secure, and litigation impeded the progress of irrigation to a greater degree than in the latter. Thus in the Modesto-Turlock District on the middle slopes of the alluvial fan of the Tuolumne River, irrigation in any important way did not begin until 1888, and in 1909 the combined acreage of vines and orchards occupied only 21 per cent of the irrigated lands.³⁸ In order to secure water from the Tuolumne River to irrigate this district a masonry and concrete diversion dam, 126 feet in height, was built in the canyon of the river. Up-stream from the dam a large reservoir has been built at Don Pedro to assist in controlling the flow of the river. From the diversion dam a long canal on either side of the valley carries the water 20 miles from the dam to the head of the irrigated areas. Water is diverted into one of these canals through a 600 foot tunnel in bed-rock, and for the first few miles of their length both of them required expensive construction on account of the irregular topography of the foothills.³⁹ The diversion

³⁷ Irrigation map of Central California, U. S. Dept. of Agric., Bureau of Public Roads, Irrigation Investigations, 1922.

³⁸ Cone, *op. cit.*, pp. 48-9.

³⁹ *Ibid.*

dam alone cost more than half a million dollars, and the system was developed only after well organized companies took hold of the enterprise. This situation is in striking contrast to the simple dams and ditches built either by a small company or by a community in the Kings River District. In the case of the Merced River, while the diversion of the water does not require as expensive an outlay as was true of the Tuolumne River, irrigation has been delayed because grain raising on the heavy rich soils which characterize this district long has been successful. Much of the land has been held in large estates which have not developed irrigation in an important way. However, Merced County has under construction a reservoir on the Merced River which it is announced eventually will irrigate 200,000 acres.⁴⁰ Similarly it was many years before the ranchers in the piedmont area contiguous to the Stanislaus River became interested in irrigation. For this reason a number of irrigation companies failed, and as late as 1909 irrigation in the district was not organized satisfactorily.⁴¹ On the whole, therefore, it is apparent that in the early period when the raisin industry was becoming established in the San Joaquin Valley the Fresno district had the advantage of a more satisfactory irrigation situation. Even at the present it is more advanced than any other districts, with the single exception of the Modesto-Turlock District. This fact, combined with the somewhat more satisfactory summer and early autumn weather in the Fresno District than in the more northerly districts, represents, in large part, the regional assets which have been capitalized in the development of the raisin industry in the Fresno District.

(2) *Relation to Legal Aspects of Irrigation.*—Although the irrigated lands in California exceed in area those of any other state, on the whole, the laws of California have not encouraged irrigation. Geographically, this apparently paradoxical statement is not surprising when the striking contrasts in the natural environment within this state are in mind, and particularly when the legal heritage of the commonwealth is explained. At times, and particularly in certain places, litigation over water-rights has stifled enterprise and hindered the development of economic activities. In the San Joaquin Valley, the progress of irrigation in all of the districts has been handicapped to some extent by legal controversies. However, the Fresno District has been affected less than the other piedmont districts. This was

⁴⁰ Boone, W. P.: Defeating the Dry Year with the Aid of the Pump, *The Associated Grower*, May, 1924, p. 10.

⁴¹ Cone, op. cit., p. 55.

true particularly during the early period in the development of the raisin industry and constitutes another reason for the localization of raisin culture in that district.

The conflicts over the utilization of the water resources of California grew out of the introduction into the state of two legal practices which in certain of their aspects are diametrically opposed. In 1850, upon its admission to the union, California adopted the English common law as the rule of decision in all courts of the state, when that law was not in conflict with the constitution of the United States or that of California.⁴² Thus was introduced the principle of riparian rights under which any landowner whose property lies along a stream has the right to the unpolluted and undiminished flow of this stream through or past his land. The state, however, inherited from two sources established custom and usages which gave the right to "appropriate, divert and use water."⁴³ The first of these carries back to the land grants made, under Spanish or Mexican rule, to Americans and others. In the Guadalupe-Hidalgo treaty the United States guaranteed the rights invested by these grants which permitted, under certain regulations, the appropriation of water by individuals or communities for irrigation and other uses.⁴⁴ Thus the city of Los Angeles long has claimed the use of the entire flow of the Los Angeles River under the rights which it maintains were granted to the original pueblo founded under Spanish law in 1781.⁴⁵ The state also inherited and promptly adopted the custom established by the forty-niners who had settled upon the public domain. This custom recognized that just as priority of occupation validated a claim, so priority of appropriation established the right to use water to work the claim.⁴⁶ California, therefore, from the outset was saddled with irreconcilable laws in regard to the utilization of its water resources. The doctrine of riparian rights, while appropriate in humid England where an unimpeded flow of the streams is necessary to the proper drainage of the land, to the development of water power, and to navigation, is not suited to the needs of a commonwealth in which irrigation is the basis on which much of its agriculture rests.⁴⁷ The principle of appropriation which is founded on Roman law and was introduced into California during

⁴² Mead and others: *op. cit.*, p. 234.

⁴³ *Ibid.*, pp. 118-9.

⁴⁴ *Ibid.*

⁴⁵ *Ibid.*, p. 335; Hall, W. H.: *Irrigation in Southern California, Pt. II of Report of the State Engineer of California on Irrigation and the Irrigation Question* (Sacramento, 1880), pp. 558-70.

⁴⁶ Hall: *op. cit.*, pp. 118-9, 234; Bancroft, H. H.: *History of California*, VII, p. 12.

⁴⁷ Mead and others: *op. cit.*, p. 42.

Spanish and Mexican rule was much better suited to the development of irrigation.⁴⁸ It must be remembered, however, that at the time the doctrine of riparian rights was adopted, many of the activities of the state were centered about San Francisco Bay and along the lower navigable reaches of the Sacramento and San Joaquin rivers where agriculture without irrigation was practicable. To that part of the state the principle of riparian rights may have been fairly satisfactory. In this connection it is of interest to note that this doctrine long since was abrogated in all the states wholly within the arid sections of the United States.⁴⁹ The practice of appropriation met with little opposition as long as it was confined to the non-navigable head streams of the rivers in the non-agricultural sections of the state.⁵⁰ Apparently also it was in general more satisfactory in southern California where the streams are not navigable and where irrigation is indispensable to most of the agriculture. In the San Joaquin Valley, however, the conflict of opinion over the utilization of the water resources led to prolonged legal controversies which in some of the districts have been deleterious to their development.

(3) *Effect of Large Land Holdings.*—In general, irrigation developed earlier on the piedmont slopes in the middle and upper sections than in the lower sections of the San Joaquin Valley. As has been stated previously, this was due in part to the greater difficulties attendant upon the diversion of water from the rivers in the lower valley, but it was also due to the greater importance of stock ranching and grain farming in those sections and to the opposition of these interests to irrigation. In the upper portions of the valley south of Kings River, grain farming did not become as thoroughly established as in the lower valley, largely because the rainfall in the former is smaller in amount and more variable in its distribution than in the latter. Both livestock raising and grain farming were profitable mainly to owners of large ranches, and consequently huge land holdings and an attendant sparse population characterized the early development of the San Joaquin Valley.⁵¹ Although the stockmen occupying the moist grass lands in the trough of the valley early practised some irrigation to supplement their pastures, in general the owners of such estates were prejudiced against irrigation, were impatient with its difficulties, and resisted its development. In some instances the owners of land along the streams in the trough of the valley, under the doctrine of riparian rights, suc-

⁴⁸ *Ibid.*, p. 119.

⁴⁹ *Ibid.*, p. 42.

⁵⁰ Bancroft, *op. cit.*, p. 12.

⁵¹ Nordhoff, C.: *California* (New York, 1874), pp. 182-88.

cessfully opposed the diversion of water upon the upper and middle piedmont slopes.⁵² In the lower part of the valley where diversion from the deeply trenched streams required a strong organization, considerable capital and somewhat difficult engineering, the opposition of the owners of the large estates was particularly effective.

(4) *Effect of Early Development of Irrigation in Kings River District.*—In the area irrigated from Kings River (Fresno District) a number of conditions contributed to the early development of irrigation. Before railway transportation in 1870 opened the district to settlement, livestock ranching was the only economic activity of importance. The center of the activities of these ranchers was in the grass lands in the trough of the valley, but during the rainy winter season their herds and flocks pastured on the native grasses which grew over most of the floor of the valley. In the summer they were driven into the mountains. Following the construction of the railroads much of this public domain was settled by grain farmers.⁵³ However, irrigation began as soon as the area was settled and the culture of the raisin grape and other fruits introduced. Subsequently, the failure of wheat ranching on the relatively light soils and in the scant rainfall which characterizes this district as contrasted with the success of the irrigated vineyards, led to a rapid extension of viticulture and irrigation.⁵⁴ This development was favored greatly by the colony system by which much of the district was settled. These colonies, such as the Washington, Central, Fresno, and Scandinavian colonies near Fresno, divided the land which they controlled into small ranches suitable to the intensive culture demanded by fruit growing. Moreover these colonies provided the community of interest and the organized labor required in building the irrigation dams and ditches.⁵⁵ As a result, nearly twenty main canals were constructed, which naturally led to much litigation over water rights. In most instances, however, working agreements between the communities or other parties concerned were established and proved more successful than any procedure authorized by the laws of the state.⁵⁶ In the localization of the raisin grape in this district the significant fact is that, by these agreements, irrigation was established successfully in a situation suited to this fruit. It may be, therefore, that early in the experience of these colonies the seeds of cooperation,

⁵² Mead and others, op. cit., pp. 237-58.

⁵³ Soil Survey of the Fresno Area, California, U. S. Dept. of Agric. Field Operations of the Bureau of Soils, 1912, pp. 2093, 2097.

⁵⁴ Ibid.; Mead and others: op. cit., pp. 259-60.

⁵⁵ Ibid., p. 218.

⁵⁶ Ibid., pp. 259-60, 276-7, 317.

which has characterized the raisin industry in recent years, were sown. Subsequently much of the water for the district came into the control of two companies which, operated under one management, formed in 1912 the largest single irrigation enterprise in the state.⁵⁷

The rapid development of irrigation in California after 1875 with its attendant litigation, led to many attempts to remedy the situation by modifying the laws of the state. A long series of state and federal investigations were made, and at one time, the state engineer was dispatched to Spain, France and Italy to study the history, customs, practices, and laws applying to irrigation in those countries. The report published by this commission contains much significant geographic material about irrigation in those countries, and the findings exerted a considerable influence on opinions and subsequent irrigation legislation in California. A complete geographic interpretation of the progress of irrigation practices and the modification of the laws surrounding the utilization of water resources in California, patently is beyond the scope of the present study. In its entirety it would constitute a remarkable illustration of the struggles of a great commonwealth to modify its legal inheritance so that its citizens might capitalize, through the development of irrigation agriculture, the outstanding elements in their natural environment.⁵⁸

(5) *Relation to Irrigation from Ground Water.*—As irrigation developed in the Fresno and other piedmont districts it was found that it was impracticable to build ditches to all parts of the plain, particularly to points distant from the major canals, and that during the drier seasons the supply of water from the river was not adequate for all of the irrigated lands. Moreover, in the Tule and Kaweah River and other districts the supply from the run-off does not last far enough into the irrigation season to insure successful fruit crops. As a result, in some of these areas water has been obtained by tapping the enormous volume of ground water in the sediments of which the plain is composed. A few flowing wells have been drilled, but in most instances pumps are

⁵⁷ Rep't. of the Conservation Commission of Calif., 1912, p. 207.

⁵⁸ Material relating to this important question is contained in, Irrigation of the San Joaquin, Tulare, and Sacramento Valleys, California, *House Ex. Doc. No. 290, 43d Cong. 1st Sess.* (1874); Grunsky, C. E.: Irrigation near Fresno, California, *U. S. G. S. Water Supply and Irrigation Papers No. 18* (1898); Mead, Elwood, and others: Report of Irrigation Investigations in California, *U. S. Dept. of Agric., Office of Exp't. Sta's. Bull. No. 100* (1901); Roeding, F. W.: Irrigation in California, *ibid.*, No. 237 (1911); Cone, Victor M.: Irrigation in the San Joaquin Valley, *ibid.*, No. 239 (1911); Adams, Frank: Irrigation Resources of California and Their Utilization, *ibid.*, No. 254 (1913); Report of the Conservation Commission of the State of California on Irrigation in California (1917).

required. This method has not been practicable at points where the ground water table lies deep beneath the surface. In such places the expense of driving and operating wells is so great that a proper return cannot be earned on the money invested. The exact depth from which it has been found practicable to pump water for irrigation has varied with the earning power of the crops. In 1912 it was held "that with a lift of 50 feet or less all the crops grown in this area, with the exception of grain, may be profitably irrigated by pumping, but when the lift goes beyond that figure the cost of pumping increases rapidly and only very remunerative crops will justify the expense."⁵⁹ In the foothill belt of the piedmont irrigated districts the ground water table is 80 or more feet beneath the surface. As most situations in this belt are too high above the streams to be reached by diversion ditches, it is argued that irrigation is impracticable except on frost-free sites where orange groves, small outposts of the citrus belt, yield returns which offset the high cost of irrigating from deep wells.⁶⁰

It is evident that the change of the raisin crop in the last decade from a crop which seldom produced interest on the investment involved, to a steady money-maker must have made it possible to irrigate areas where formerly the expense of irrigation would not have been justified by the return from the crop. In fact, in Fresno County the number of pumped wells used for irrigation increased by 1,426 from 1910 to 1920, and the number of farms irrigated increased by 46.7 per cent in that decade. In 1919, water from 34 flowing wells and 2,547 pumped wells supplemented that diverted from the river in the district irrigated from Kings River,⁶¹ while in 1924 it is estimated that 15 per cent of the vineyards are irrigated from wells.⁶² This increase in the use of wells may be due in part to the stabilization of the cost of pumping by the use of electricity generated at dams recently constructed in the Sierras. Thus, changing economic conditions make it possible to make new adjustments to the natural environment.

Under existing conditions the area in Fresno County irrigated by gravity canals practically has reached its maximum. As the immediate surface water of the plains carries too much mineral matter for irrigation, and as some of the artesian wells are ruled out for the same reason any considerable extension of the lands irrigated must be obtained either by further utilization of the ground water

⁵⁹ Soil Survey of the Fresno Area, California, U. S. Dept. of Agric., *Field Operations of the Bureau of Soils*, 1912, p. 2158.

⁶⁰ Ibid.

⁶¹ Irrigation: California, Fourteenth Census of U. S., 1920, p. 11.

⁶² Estimate of Division of Public Relations of the Sun-Maid Growers Association.

or by impounding the spring flood waters in expensive reservoirs in the mountains. As the latter will involve legal as well as economic considerations, such reservoirs probably will not be built until a more complete utilization of ground water is made than at present.⁶³

In the current season (1924) the raisin growers face what appears to be a serious shortage of water. Last winter the fall of snow in the high Sierras was extremely light and although considerable rain fell in the early spring it is declared that the present season is the driest of the forty-two seasons on record. On this account it is predicted that many of the canals in the district irrigated from Kings River will be dry during most if not all of the irrigating season. Apparently conditions are as serious throughout the San Joaquin Valley, except in the Modesto-Turlock district which has the advantage of the completed storage reservoir at Don Pedro on the Tuolumne River. It is significant to note that this shortage of water is acting as a spur to the interests projecting storage dams in the mountains. The *Associated Grower*, the official journal of the raisin, fig and peach growers, in a recent issue carried the statements that "the many irrigation systems of Fresno County are seeking ways and means of uniting into one great district to construct a storage reservoir at Pine Flat, on the Kings River, some 35 miles east of Fresno. The Pine Flat project will guarantee an ample water supply for 750,000 acres now wholly under the gravity systems and approximately an additional 250,000 acres now without a dependable supply of gravity water."⁶⁴ This shortage of water will be relieved in some sections by the use of pumps. Some of the canal companies commonly use ground water to supplement that diverted from the rivers and in some places, like Visalia on the alluvial plain of the Kaweah River, and Pixley and Tipton on that of Tule River the vineyardists depend almost if not entirely on wells. It is apparent that vineyards and tree crops in situations where the water supply is most uncertain may be killed or damaged greatly. In this connection it must be remembered that, under the lure of the high prices for raisins which prevailed in the years immediately following the war, the acreage planted to vineyards increased greatly. It is probable that, as the acreage expanded, vineyards were planted in places where the water supply is uncertain or which are unsuited to them for other reasons. If this be true the current water shortage may result in a decrease in acreage. At least it probably will throw into relief the situations which are unsuited or less well suited for

⁶³ Soil Survey of Fresno Area, op. cit., p. 2158.

⁶⁴ Boone, W. P.: Defeating the Dry Year with the Aid of the Pumps, *The Associated Grower*, May, 1924, p. 10.

vineyards. If it slows up the rate of increase in raisin production, it should prove helpful to the marketing phase of the industry by allowing it a longer period in which to widen the rapidly expanding market for California raisins. If, therefore, this vagary of the weather results in the canal companies finding a way around the legal and financial difficulties associated with the construction of a reservoir, if it demonstrates that the raisin grape is not the crop best adapted to certain marginal lands, and if it counteracts what might have become an over-expansion of acreage and production—if, geographically speaking, the industry becomes more thoroughly adjusted to the natural environment, it may initiate, in the long run, another stage in the progress of the industry.

PART III. VINEYARD PROBLEMS AND PRACTICES AS RELATED TO THE NATURAL ENVIRONMENT

Drainage Maladjustments.—One of the significant results of irrigation in this district has been the gradual rise of the surface of the ground water table. In some places this condition has increased the availability of the ground water for pumping and in others has lessened the need of irrigation. In other sections it has had a disastrous effect on the vineyards. A striking example is the section west of Oleander and south and west of the city of Fresno where thirty years ago the Washington and Central colonies, boasted the finest vineyards in the district (Figs. 1 and 8). Continued irrigation threw a burden on the drainage courses and facilities of the district greater than they could bear and the water table gradually approached the surface. As a result, in some places alkali accumulated in the soils, while, in others, the land was flooded. Slowly the vineyards were damaged and the growers were forced either to start new vineyards higher up on the plain or to turn their attention to alfalfa culture and dairying. After a time, alfalfa would not grow and the areas became Bermuda and salt grass pastures. The situations where alkali is most pronounced are now devoid of vegetation except for the more alkali-resistant weeds. In some places shallow pools of water supporting cat-tails and other swamp vegetation cover areas formerly occupied by thriving orchards or vineyards. Thus, these areas, which less than a century ago were unoccupied land beyond the frontier of civilization, have in the span of a human life passed through a series of economic stages including livestock ranching, large-scale wheat raising, raisin vineyards, alfalfa culture and dairying, and, finally, have become unproductive alkali plains or swamp land. Of course the areas described are only a small fraction of the total area irrigated in this valley. In many places

a satisfactory balance between irrigation and drainage apparently has been reached, for the general level of the ground water table has not risen in years. However, irrigation experts emphatically state that unless extensive drainage systems are introduced in many parts of the area, the tragedy of the Washington and Central colonies will be repeated.⁶⁵

Adaptations to Soil.—The several varieties of raisin grapes, taken as a group, grow successfully in a rather wide variety of soils. In fact, it is stated that in the Fresno District "with the exception of the olive and the fig, the grape has a wider soil adaptation than any other crop grown in the valley," and that "excepting the alkali soils, there are no soils in the area which are not well adapted to some of the varieties of grapes."⁶⁶ The peach, which is the fruit crop second in importance in the Fresno District, apparently is much more closely related to particular soils, as it is confined mainly to the lighter sandy loams of two soils series, and is even more intolerant of alkali than the grape.⁶⁷ It is fortunate that the raisin grape is somewhat cosmopolitan in its soil requirement because this piedmont alluvial plain displays a considerable variety of soils. Practically all of the soils occupied by the vineyards were formed from alluvial deposits spread over earlier marine or freshwater sediments by the streams which drain the western slope of the Sierra Nevada Mountains. These soils have a diverse chemical composition which reflects the complex geological structure of the Sierras. This diversity of composition, together with the physiographic processes under which they were laid down, and the aridity of the valley, largely accounts for their physical character.⁶⁸ One characteristic of great importance to the vineyards is their lightness and consequent permeability and ease of cultivation. This permits the roots of the vines to penetrate to depths which in many other places would be impossible. Hilgard found ends of grape roots at a depth of 23 feet in a gravelly clayloam. In places the alluvial materials were so unconsolidated that they settled a number of feet after the first irrigation and it was necessary to exercise great caution in irrigating near farm buildings.⁶⁹

As a result of the diversity of soils in the raisin district, one of the problems which required much study and experimentation in the

⁶⁵ Fortier, S. and Cone, V. M.: *Drainage of Irrigated Lands in the San Joaquin Valley, Calif., U. S. Dept. of Agric., Office of Exp't. Sta's. Bull. 217*, pp. 9-14.

⁶⁶ Fortier and Cone: *op. cit.*, pp. 2100, 2101.

⁶⁷ *Ibid.*, 2101.

⁶⁸ *Ibid.*, 2105-13.

⁶⁹ Grunsky, C. E.: *Irrigation near Fresno, Calif., U. S. G. S. W. S. I. Papers, No. 18*, p. 79.

extension of the vineyards was the selection of soils suited to the vines and of varieties of the grape best suited to certain soils. In the early days of the industry it was thought that certain light colored sandy soils (the Fresno series) were the only ones adapted to grape culture. From time to time experiments were made on other soils, and the success of the vineyards on some of these disproved the earlier theories.⁷⁰ In this way soil type after soil type was added to the approved list and, in consequence, the spacing of the vineyard became more compact. The number of soils on which raisin grapes are grown profitably is increased because in general the Muscats do best on deep fertile loams while the Thompson Seedless and Sultana varieties do as well or better on lighter loams. The Thompson Seedless variety was not cultivated on a commercial basis in the Fresno District until about 20 years ago. When it was demonstrated that, in this district, it produced fairly good crops on the sandy soils and sandy loams in which other varieties did not pay, the acreage devoted to it increased rapidly.⁷¹

Relations to Climate.—The culture of raisin grapes and the production of raisins are so definitely related to the particular variation of the Mediterranean type of climate possessed by the San Joaquin Valley that, without this valley, the raisin industry in the United States would be reduced to insignificant proportions. The fact that a satisfactory crop of raisins has been produced with great regularity since raisin culture was introduced into the Fresno District attests the general suitability of the climate for this crop. It must not be thought, however, that there are no weather hazards in raisin culture in this district, for in reality the size and quality of the raisin crop in a particular year depends, to a notable extent, upon the weather. While the most critical period in raisin production is in late summer and early autumn, the crop may be injured by unseasonable weather at almost any time during the year. Successful raisin culture is attained only by employing vineyard practices which have been evolved by years of experience and experimentation. In certain years weather conditions develop against which protective measures cannot be taken. In such years the crop is reduced in quantity and in some instances in quality.

(1) *Frost Hazards.*—The raisin grape is a deciduous vine and to produce at its best requires a season of recuperation. In the San Joaquin Valley this is brought about by frost which occurs at intervals

⁷⁰ Ibid., p. 2099.

⁷¹ Nougaret, R. L.: Status of California Grape Industry, Calif. Dept. of Agric., Spec. Publ. No. 28, June 30, 1922, p. 20.

during the winter.⁷² These frosts seldom, if ever, are severe enough to damage the vines, because ordinarily a dormant vine is not injured unless the temperature falls below 20° Fahrenheit, and temperatures as low as that are infrequent. In fact the absolute minimum temperature at Fresno stands at 17°.⁷³ Moreover, it is stated that well matured vines on dry ground will withstand temperatures somewhat below that figure.⁷⁴ During the latter part of the winter the vines are pruned and the ground is plowed—the winter weather not being severe enough to hinder either operation. Because “freshly plowed soil radiates its heat and renders frost more likely,” growers operating land in situations where frosts are severe are advised not to plow and harrow their vineyards immediately before the buds start.⁷⁵ Practice has demonstrated that late pruning is an effective way of preventing damage from spring frost because “the buds swell first at the ends of the cones, if we prune at this time the fruit buds of the spurs will be quite dormant.”⁷⁶ It is stated that irrigation prevents damage from frost, provided water in considerable volume can be applied.⁷⁷ Smudge pots have been used at times but their use is not a common practice.

The greatest danger from frosts occurs about the middle of April when the grapes are in bud. At that time the buds may be damaged by even a slight frost. The raisin grape, especially the Muscat and Muscatel varieties, is so highly bred that cold or cloudy weather prevents fecundation of the flowers. Unfavorable weather may mean that less than half of the bloom bears fruit. The damage from frost occurs, in most instances, at the beginning of the blooming period, thus decreasing the amount of first-crop grapes. This ultimately affects the profits of the growers for, in general, the first-crop grapes make the largest and highest priced raisins. Moreover, the first-crop raisins ripen much earlier than the second crop and thereby stand a greater chance of being properly cured before the cooler, moister autumn weather begins. Thus the success of the year's operation partially depends upon the character of the weather during the blooming period.⁷⁸ Rain, unless fol-

⁷² Eisen, Gustav: *The Raisin Industry* (San Francisco, 1890), pp. 53, 64.

⁷³ *Annual Meteorological Summary*, Fresno, Calif., 1923.

⁷⁴ Biolette, F. T.: Protecting Vines from Frost, *The Sun-Maid Herald*, Jan., 1918, p. 4.

⁷⁵ *Ibid.*

⁷⁶ *Ibid.*

⁷⁷ Bonnett, W. E.: Keeping Weather Eye on the Frost, *Sun-Maid Herald*, May, 1919, p. 16.

⁷⁸ Pierce, N. B.: Grape Diseases on the Pacific Coast, U. S. Dept. of Agric., *Farmer's Bull.* No. 30, p. 12.

lowed by frosts, does little damage. Although at times a spring frost, as in the spring of 1921, has done great damage to the grapes, in most years the weather during this season of the year is satisfactory for the crop. In fact Bonnett states that "In about one year in ten, spring frosts general enough and severe enough to materially reduce the total crop may be expected."⁷⁹

(2) *Summer Assets.*—Raisin grapes grow so well in the hot dry summer weather of the San Joaquin Valley that there is but little danger of injury to the crop at that time of the year. However, in a few years they have been damaged by a period of excessive heat, especially when the heat is accompanied by high winds, at the time when the fruit is "setting." Under such conditions many berries drop and the clusters do not fill well.⁸⁰ In some instances the leaves and even the berries on the sides of the vines exposed to dry winds are scorched. After a few days the berries dry up and the bunch is lost. This hazard, according to Eisen, is offset for the Muscat variety by the common practice of growing the vines so low that the leaves cover the berries.⁸¹ The losses from this cause are, however, too infrequent and too small to handicap the industry. In the San Joaquin Valley the crops are not injured by storms, as are crops in many years in eastern United States. Thunderstorms and hailstorms practically are unknown in the growing season, and winds of a velocity sufficient to damage the crops are absent.

During the summer the vineyards require much attention. A well managed vineyard is free from weeds and is a fine example of careful tillage. Beginning in April they are cultivated three or four times until the growth of the canes prevents further cultivation, and are hoed once or more in May or June.⁸² Irrigation commonly is practiced in April and again in July. In addition to these tasks the grower must make his preparations for the picking season. In fact during most of the year the growers are so busy with their vineyards that, although some of them do raise other crops and diversification of crops is urged by certain of the agricultural authorities, many of the growers devote much of their land and most of their attention to their vineyards.

(3) *The Critical Ripening and Curing Season.*—The most critical

⁷⁹ The writer is indebted to Mr. W. E. Bonnett, Meteorologist in charge of the Fresno station of the Weather Bureau, for information in regard to the relation of raisin culture to weather.

⁸⁰ Bonnett, W. E.: *Forecasts for Raisin Makers, Mo. Weather Rev.* Vol. 38, p. 1593

⁸¹ Eisen; *op. cit.*, p. 65.

⁸² Soil Survey of the Fresno Area, *op. cit.*, p. 2100.

period in raisin grape culture, and therefore the time of greatest anxiety for the growers, is during the ripening and curing season which extends from early in August to about the end of October. During the earlier weeks of the period the grapes ripen and sugar is stored in the berries. The raisin grape grows and ripens best under direct, intense sunlight because a maximum amount of sunlight results in both the requisite physical and chemical action on the growing fruit.⁸³ Under the combination of continued intense sunlight, dry air, high temperatures, and sufficient soil moisture (supplied by irrigation) which prevails in the San Joaquin Valley, the growth and ripening of the raisin grape proceeds most satisfactorily. At Fresno during 36 years of record the months of May, June, July and August have had an average of 90 per cent or more of possible sunshine.⁸⁴ On the contrary, the raisin grape does not ripen satisfactorily in the somewhat more diffused sunlight and higher humidities prevailing along the California coast.

In general, the sugar content of the grapes and the time of ripening depend upon the weather during the growing season. A propitious season means that the grapes ripen early and are rich in sugar, while a backward spring and a cool, humid summer delay the ripening and reduce the sugar content. As a rule the best quality of raisins are produced from the first-crop grapes because they ripen early enough in the season to assure a high sugar content and dry, hot weather for curing. While the grapes do not ripen on the same date every year and the ripening varies from place to place with the soil and exposure, the grapes in the Fresno District ripen about the middle of August.⁸⁵ In that month, the weather in this district is characterized by high temperature, cloudless skies and low humidity. Although the range of temperature and humidity is great from day to night, the average humidity for the summer months at Fresno is only 35 degrees. The relative humidity is lowest in the hottest period of the day, when it commonly is about 15 per cent. However, even at night the humidity is low, for a piece of tissue paper lying out all night will be dry and crisp in the morning.⁸⁶ Under the spur of such heat and aridity the raisin grape ripens most satisfactorily. If rain occurs during the ripening period the vines renew their vegetative growth and a low sugar content in the fruit results. In the Fresno District this seldom

⁸³ Palmer, A. H.: *The Agricultural Significance of Sunshine as Illustrated in California, Mo. Weather Rev.*, March, 1920, p. 152.

⁸⁴ *Annual Meteorological Summary*, Fresno, Calif., 1920.

⁸⁵ *The Associated Grower*, Aug., 1920, p. 9.

⁸⁶ Hummann, Geo. C.: *Grape, Raisin and Wine Production in United States. Year-book, Dept. of Agric.*, 1902, p. 414.

has happened because in the 43 seasons from 1881-82 to 1923-24 the weather record at Fresno shows a rainfall figure in August in only three years (.15" in 1896-97, .08" in 1916-17, .15" in 1920-21) and reports a trace of rain in only 13 other years. In 27 years no rain is reported.⁸⁷

While the beginning of the picking season varies from year to year and from place to place, in the Fresno District it usually is about August 20. Although picking continues through September, most of the grapes are on the trays by the middle of that month. Unless grapes contain 22 per cent or more of sugar they do not make satisfactory raisins. In fact, if the sugar content falls much below that percentage only sour, shrivelled, dried grapes can be produced from them. Naturally the growers become expert in judging the sugar content of the grapes, but in recent years the practice of determining the sugar content accurately by means of a saccharimeter has been introduced. The Sun-Maid organization encourages this practice by placing saccharimeters at numerous of their packing plants to which growers can bring their grapes to be tested. If the tests show that the sugar content of the grapes is below 22 per cent, picking commonly is postponed. Great loss of weight as well as quality results if the grapes are picked too green. It has been demonstrated that "Thompsons picked at 22 per cent weighed about one pound per tray less when dry than when picked at 25 per cent. If one vine yields one tray of raisins and there are 600 vines to the acre, by picking the grapes at 22 per cent, it would cause a loss of 600 pounds, or at 10 cents per pound, \$60 per acre."⁸⁸

The job of picking the grapes is a big and expensive one. As the grapes are picked they are placed on wooden or paper trays, 22 pounds being placed on each tray. The filled trays are placed side by side on the ground between the row of vines (Fig. 13), where in the brilliant sunshine and dry air characteristic of this valley they cure in about three weeks.⁸⁹ Various methods are used in placing the trays so that the grapes will receive the optimum sunlight and thus cure as well and as quickly as possible, and so that the trays may be handled conveniently. Under the influence of the sun the water in the grapes is evaporated and juice is converted into sugar and other solids. After the grapes on the exposed side become a purplish brown, they are turned and the other surface exposed to the sun. When both

⁸⁷ *Annual Meteorological Summary*, Fresno, Calif., 1923.

⁸⁸ *The Associated Grower*, Aug., 1920, p. 9.

⁸⁹ Bonnett, W. E.: *Forecasts for Raisin Makers*, *Mo. Weather Rev.*, Oct., 1910, p. 1593.

sides have attained the proper color the trays are stacked. In the stacks the moisture in the grapes evaporates slowly, the rate depending on the weather. This plan of finishing the curing in the stacks or shade produces a better quality of raisins. It also is essential if the raisins are to be packed in clusters or layers because otherwise the stems become so dry that they break as they are packed.

Because raisin grapes are the money crop for most of the growers, the harvest season is an anxious time. Many of them have no other



FIG. 13. Thompson Seedless grapes curing in the brilliant sunshine and dry air characteristic of the early autumn in the middle and upper sections of the San Joaquin Valley. These conditions, essential to the production of sun-cured raisins, are present in but few places in the world. They constitute the major condition to which the raisin industry in the San Joaquin Valley is related.

farm interest and consequently the grapes spread on the trays are the visible evidence of an entire year's work. So much depends upon their getting the grapes picked at the proper time and upon their being able to stack the trays in case of rain that the labor problem is most acute. During the harvest season idle men are unpopular in the raisin country. Men, women and boys are pressed into service, and at times in the past when the exposed grapes were threatened, schools have been dismissed and itinerants practically have been com-

mandeered. Wages, as a rule, are high, and Japanese, Mexican, Indian, and Italian laborers and men from the cities flock into the district. Most of the picking is done at a stipulated price per tray, as it has been found that more grapes are picked in a given time under this method. At times the picking is let to contractors who recruit gangs for the purpose. Once the grapes are ripe, the earlier they are exposed on the trays the greater the likelihood of their becoming good raisins; consequently the growers are not unwilling to pay a high price for the necessary labor. The temporary laborers are housed in camps provided by the employers. Under the state law these camps must be kept clean and sanitary.⁹⁰ During the shortage of labor in 1918 the Valley Fruit Growers' Association was created to assist in distributing labor in the fruit districts, and since has given valuable assistance in this important problem.⁹¹

Although in a few years the amount of the raisin crop has been decreased and its quality impaired by rainy or humid weather, in most years a large crop of high quality raisins has been produced. This regularity of production of raisins occasioned by the favorable weather in the harvest season is the outstanding asset of the Middle San Joaquin Valley, and the concentration of the raisin industry in the Middle San Joaquin Valley represents the utilization of this regional resource. In most seasons the weather in September and October is characterized by clear days, brilliant sunshine, low humidity and light and infrequent rains. At Fresno in 36 years of record there was 90 per cent of possible sunshine in September and 87 per cent in October. In the 43 Septembers from 1881-82 to 1923-24 inclusive, 10 had no measurable rain, 9 had a trace, and only 4 had more than one inch. In this period there were 8 Octobers without rain, 2 with only a trace and 9 with more than one inch.⁹² The rainfall record, however, does not reveal the complete story, because a slight rain followed by dry winds does little damage, while the same amount followed by humid conditions would do much damage. In general the ratio of bad to fair or fine curing seasons is about 1 to 8. Thus since 1900 the unseasonable weather during September and October in 1904 and 1916 materially reduced the quantity and quality of the pack. The years 1910 and 1918 were also unsatisfactory seasons, although not to the same extent as 1904 and 1916. In 1916 it is

⁹⁰ *Sun-Maid Herald*, July 1912, p. 12.

⁹¹ *The Associated Grower*, May, 1921, p. 41.

⁹² Bonnett, W. E.: *Annual Meteorological Summary*, Fresno, Calif., Fresno Weather Bureau Office, Jan. 25, 1924; see also same author's article in *Sun-Maid Herald*, Sept., 1917, p. 8.

estimated that at least 25 per cent of the crop was lost during a protracted period of showery, cloudy weather, with subnormal temperatures which occurred during the closing days of September and the early part of October.⁹³

During the critical months of the harvest, close watch of the weather is made by the growers and by the weather station at Fresno. The forecasts of the weather bureau mean much to most of the fruit districts of California, but probably in none are they followed with greater care than in the raisin districts. In case of impending rain, forecasts are issued by telephone and otherwise to all parts of the district. Immediately all possible workers are recruited and the trays stacked and covered. It requires much labor to stack the vast number of exposed trays so that the workers ask and receive high wages for the work. One of the important results of the forecasts is that they save the growers from unnecessary labor and expense at times when some slight indications of rain are evidenced but no general rain is probable. "Thus the Bureau has saved much to the growers by its timely warnings of rain and it has also effected a great saving for them in avoiding needless stacking."⁹⁴ At times in the past Japanese laborers have watched the weather bulletins and when a rain was forecasted have struck for higher wages. Truly the adaptations to weather are infinite.

In recent years the acreage planted to the Thompson Seedless variety has increased much more rapidly than that of the other varieties. This is due to the growing popularity of the seedless raisins, to the fact that a considerable quantity of this variety is shipped as a table grape, to its adaptability to light sandy soils unsuited to other varieties, and to the fact that as it ripens early it is more certain of being cured properly. This last consideration is of great importance because it enables a grower who has both Muscats and Thompsons to start his picking season earlier than otherwise would be the case. This is an advantage, for at best the picking season is a brief, congested period. The early ripening of the Thompson Seedless variety adapts it to the early arrival of humid autumn weather in the Sacramento Valley. In these northern counties more than 80 per cent of the total acreage in 1922 was planted to this variety. The curing of raisins in these northern localities is accelerated by dipping them in caustic soda or oil, or by bleaching them with sulphur. Probably if it were not for the utilization of early ripening varieties and

⁹³ *Monthly Weather Record*, Sept., 1916, p. 106; Oct., pp. 117-18.

⁹⁴ Bonnett, W. E.: Forecasts for Raisin Makers, *Monthly Weather Bureau*, Oct., 1910, p. 1593.

of artificial ripening processes, the raisin crop in the Sacramento Valley would prove a failure in about two out of three years. The American market for the dipped or bleached raisins is relatively limited, because the flavor is somewhat different from the fruit cured in the sun. The dipped raisins are consumed in New York and other eastern cities by Italian immigrants who are familiar with Mediterranean dipped raisins. Likewise a market for the sulphur bleached raisins is created in the same cities by the Jewish holiday demand for them.⁹⁵

Biological Hazards.—Practically throughout the history of grape culture in California the growers have faced the problems of plant diseases and of insect and animal pests. It is stated that in 1917, twenty-three different insects and seven diseases gave trouble in Fresno County.⁹⁶ The principal enemies of the vineyards are the phylloxera, the California vine disease, the mealy bug, mildew, and black scale. At times the vineyards have suffered from the linnet, quail, and other birds, and from ground squirrels and jack-rabbits. In the southern counties the rabbits, at times, have been such a nuisance that it has been necessary to hold "rabbit drives" in which the men of an entire neighborhood participated and thousands of rabbits were killed.⁹⁷

(1) *Phylloxera.*—The phylloxera was introduced into California with the vines imported from Europe during the period of experimentation which followed the settlement of the state. It has done great damage and has led to the use of resistant stock for grafting. In California, the phylloxera has spread less rapidly than in Europe, because (1) the winged form is rare in California and the wingless form must be transported by persons, wagons, implements, or cuttings, (2) in the dry air of California the swellings resulting from the bite of the louse do not develop and spread over the surface of the roots as rapidly as in moist air, and, (3) the virgin soils of California have been so rich that, together with the relatively slow progress of decay, a well cared for vine has been able to throw out new roots almost as fast as the old ones were destroyed. This gives the local vines a longer lease of life than in Europe.⁹⁸ In California the conditions of soil and climate vary so greatly from those in France that the resistant standards established in the latter in many cases do not apply in the former. Husmann states that, "The French vineyards

⁹⁵ *The Associated Grower*, Oct., 1921, p. 6.

⁹⁶ *Sun-Maid Herald*, Feb., 1918, p. 19.

⁹⁷ Husmann, G. C.: *American Grape Growing and Wine Making*, Fourth Ed. (New York, 1896), p. 223.

⁹⁸ Hayne, A. P.: *Phylloxera, Calif. Agric. Exp. Sta., Rept. of the Viticultural Work*, 1887-93, p. 378.

are largely located on limy soils and these soils are rare in California" and points out that special adaptations to local soil conditions must be made. In fact, a vine variety, which in one locality has splendid resistant qualities, perishes in another locality having the same soil but a different climate, or in another locality having the same climate but a different soil.⁹⁹

(2) *Mildew*.—Similar variations in intensity of attack and efficacy of remedies are true of other vine enemies. Mildew, a fungus disease, is present in some form or other either on the vine or in the soil throughout the year except possibly in some of the driest localities where the over wintering spores may not be produced. Humid weather, or excessive irrigation during the growing season encourages the growth of mildew. It is controlled by sprinkling the vines with dry sulphur—the number of sulphurings depending on weather conditions. In some of the coast valleys in the wine grape section of the state as many as six or more sulphurings are given in moist years. In the drier San Joaquin Valley, sulphuring in some years is omitted, but this is considered bad practice by the more efficient growers. The time of applying sulphur is adapted to weather conditions. Apparently it is recognized that after a spring or summer rain the vines must be sulphured immediately.¹⁰⁰ It is not effective unless the temperature at the time of application is 75° or above. The warmer the air the less time it takes to kill the fungus. It repeatedly has been demonstrated that a temperature of 106° or above for a period of days kills at least two thirds of the black scale. During the summer of 1896 at least 90 per cent of the scale was killed in this way in Riverside County. This does not happen in those northern vineyard localities where the air is cooler and moister.¹⁰¹

(3) *Regulatory Measures*.—A survey of the literature on this subject demonstrates that the ravages of the pests vary greatly from locality to locality. However, all of the growers are concerned in fighting the pests. In California the inspection of the vineyards, groves and orchards and the establishment of an effective quarantine against a particular pest are facilitated by the fact that most of the fruit crops are confined to well-defined irrigated areas. The great value and high return from such crops make possible a notable outlay for experimentation and preventative measures. This is in sharp contrast to

⁹⁹ Husmann, G. C.: Grape Investigations in the Vinifera Regions of the United States, U. S. Dept. of Agric., Bur. Plant Ind., Bull. No. 172, p. 11.

¹⁰⁰ Sun-Maid Herald, June, 1918, p. 4.

¹⁰¹ Marlatt, C. L.: Insect Control in California, Yearbook Dept. of Agric., 1896, p. 28.

some of the fruit districts in eastern United States where uncared for vines and trees constitute a menace to the whole industry.¹⁰² The California law provides for horticultural commissioners in each county who are empowered to enter all premises and to force action if necessary. A strict quarantine is maintained against the importation of insect and other enemies of fruit by providing for the inspection of all nursery stock and other horticultural material as it enters the state. This feature of the California law has been copied by other states, by Congress, and by foreign countries. Furthermore, the quarantine officers of the eleven western states of the union, of British Columbia, and of Mexico are now organized into the Western Plant Quarantine Board in order to protect western North America from insect pests and plant diseases rampant in the eastern part of the continent.¹⁰³

PART IV. MARKETING ASPECTS OF THE INDUSTRY¹⁰⁴

Trend of Raisin Production.—The production of raisins in California for 1923-24, estimated at 265,000 tons, represents the largest production in the history of the industry and considerably exceeds the average production of 193,000 tons for the six year period from 1918 to 1923 inclusive. In the last decade the production of raisins has grown so rapidly that the 1923 production is twice that of 1915 and three and seven-tenths that of 1913. The following table I shows the production of raisins for each year from 1895 to 1923, inclusive, and for certain years preceding 1895. It will be noted that, while in general a marked increase in production has characterized the industry, sharp fluctuations in production have been equally characteristic. The abrupt changes in production from year to year have been due in part to variations in the weather from year to year. Thus the small crops in 1921, 1913, 1910, 1904, and 1901 as compared to the years immediately preceding and following were due to some weather condition which, in the years in question, decreased production. On the other hand the rapid increases in production from 1884 to 1894, and from 1913 to 1923 represent periods of notable pros-

¹⁰² Ibid., pp. 217-9.

¹⁰³ Fleury, A. C.: California's Protective Quarantine System, *The Associated Grower*, March, 1924, p. 8.

¹⁰⁴ The writer acknowledges his indebtedness to Mr. Wylie M. Giffen, formerly president of the Sun-Maid Raisin Growers Association, for an interview in 1917 as the result of which the present study was undertaken. Thanks also are due Mr. Gerald F. Thomas, Manager of the Division of Public Relations of the Sun-Maid Growers Association, for current material on the industry.

TABLE I

THE PRODUCTION OF RAISINS IN CALIFORNIA IN TONS FROM 1894 TO 1923
INCLUSIVE AND FOR SELECTED YEARS PREVIOUS TO 1894.*

Year	Production	Year	Production	Year	Production
1873	60	1900	47,000	1912	95,000
1875	180	1901	37,000	1913	70,000
1880	1,600	1902	54,000	1914	98,000
1885	5,000	1903	60,000	1915	130,000
1889	14,000	1904	40,000	1916	136,000
1890	19,000	1905	45,000	1917	163,000
1894	52,000	1906	50,000	1918	150,000
1895	46,000	1907	75,000	1919	183,000
1896	34,000	1908	65,000	1920	174,000
1897	47,000	1909	70,000	1921	151,000
1898	40,000	1910	62,000	1922	234,000
1899	36,000	1911	65,000	1923	265,000

*Compiled from Bancroft, H. H.: *History of California*, VII, p. 49; 11th, *Census of U. S.*; *Yearbook Depart. of Agric.*, 1902, p. 415; *Sun-Maid Herald*, July, 1919, p. 17; Recent years from Division of Public Relations of Sun-Maid Raisin Growers Association.

perity in the industry, with a consequent increase of acreage and production. The more or less static production from 1894 to 1911 indicates a period of marked depression in the industry. In a number of years during this period, most of the vineyards were operated at a loss, and as has been stated previously, the progress of the raisin industry seriously was questioned.

The Marketing Problems.—During the entire course of the industry the prosperity of the growers has been determined largely by the degree of success with which they have marketed their crop. Their marketing problem has been especially critical because the principal markets for California raisins always have been in eastern United States. Thus the more important centers of raisin consumption are from 2,000 to 3,000 miles from the producing district. It is this distance factor expressed in an unsatisfactory contact between producer and consumer and in vital railway services and high freight rates, with which every important Pacific coast fruit industry contends. In this connection the importance of the service rendered by the railways which tie the Pacific valleys with the eastern half of the country must be realized. These railways cross high mountain areas through difficult passes, and in places span broad deserts in which for many miles scarcely a ton of freight is produced. In spite of these handicaps they, in general, render efficient and effective service. In addition to securing efficient railway transportation the experience of the raisin and other important fruit industries in California has demonstrated that, to

place highly specialized fruit crops in distant markets, an effective marketing structure must be erected. In 1913, after years of little or no profit on their labor and after a number of unsuccessful attempts at organization, the raisin grape growers finally created a coöperative association for marketing their product. The establishment of this association came as a rebellion against the low prices which the growers were receiving for their raisins, and against the practices of the packers who packed and consigned the fruit and who, it was alleged, in many years absorbed such profits as the industry afforded. Apparently the fundamental difficulty in the situation was that, under the former system, the marketing aspect of the industry was not adapted to the important task it was called upon to perform. This task involved the difficult business of stabilizing the industry through the establishment of a more uniform pack and price, and of promoting the demand for raisins in established as well as new markets. In view of the nature of the product, the relative unfamiliarity with the virtues of raisins as a food which prevailed in much of the country, and the distance between the producing and consuming regions, it is doubtful if the raisin industry would have advanced to its present position without a strong, centralized marketing organization. In the long run this organization, if it functions properly, should prove as useful to the consumer as the producer.

Marketing in the Pioneer Period.—A survey of the conditions which prevailed in the raisin district for three decades preceding the formation of a centralized marketing association demonstrates the importance of such an organization to the industry. The decade between 1880 and 1890 was a pioneer period during which raisin culture was tried in a number of places in the state and in which it became the leading crop in the Fresno section of the San Joaquin Valley. During this period, the production of raisins in the state and the consignments to eastern markets increased rapidly. Shipments of raisins to the east began about 1874 when a consignment of 220 pounds was made. By 1888, the shipments had increased to 16,884,570 pounds. The relation of the increase of the business to railway transportation is suggested by the decline in freight rates from 2.81 cents per pound in the former year to about 1.25 cents in the latter.¹⁰⁸ During this period most of the pioneer vineyardists prospered. They had acquired land at low cost either from the government or the railroads, their vineyards placed on virgin soils produced abundantly, and in general the prices for raisins were high. During this time profits of \$340

¹⁰⁸ Baneroft: op. cit., p. 743.

an acre are on record.¹⁰⁶ At the outset the raisin growers packed and consigned their output, but shortly merchant packers assumed this function. These packers until 1889 bought the grapes on the vines or in the sweat box. In either case the farmer received cash for his crop and the packers assumed the marketing risk. Not all the years in this early period were satisfactory ones, but on the whole the industry prospered. Consequently between 1885 and 1890 a typical western boom developed. Settlers came from eastern United States and Europe, acquired land, and planted vineyards. Many of the earlier settlers who had taken up land holdings of some size made fortunes out of the consequent rise in land values. It is stated that raw vineyard land in some instances sold for as high as \$1,000 per acre. Not only were new vineyards planted, but wine grape vineyards were grafted to raisin grapes. In some instances growers mortgaged one vineyard in order to start another. In 1890 there were approximately 30,000 acres of raisin grapes in Fresno County alone.

That such a rapid expansion of vineyard acreage occurred illustrates the relatively simple task of bringing the alluvial fan of Kings River under cultivation and the large size of this irrigated area. It will be remembered that irrigation was accomplished by means of simple dams and ditches, the construction of which involved but little beyond the efforts and resources of the local communities. For the most part the uniformly level piedmont slopes required little or no grading for irrigation, there were no forests to clear or deep rooted prairie grasses to conquer, and virgin soils replete with fertility yielded abundant crops. Under such conditions the principal requisite for success in producing raisins consisted in the adoption of the proper vineyard practices. The knowledge of such practices fortunately had been acquired by many growers after some years of practical experience, but apparently it was not shared by some of the new-comers. Many settlers were so eager to share in the raisin profits that they would not wait to learn the technique of this highly specialized business. As a result, some vineyards were planted in situations unsuited to them.

The notable increase in vineyard acreage which occurred from 1880 to 1890 inevitably led to over-production and in 1891-92 the boom collapsed. In that and succeeding years the crop sold for less than the cost of production. As a result, the speculative, ephemeral growers failed, and their vineyards, as well as those on the poor situations,

¹⁰⁶ For considerable of the material on the development of the cooperative movement in the raisin industry the writer is indebted to a series of articles by W. Y. Spence, under the title "Success after Twenty Years," beginning in *The Sun-Maid Herald*, Nov., 1917, p. 4.

were abandoned or uprooted. It is stated that in 1894 the assessor's books showed a decrease of 14,000 acres.¹⁰⁷ Many ranches bought on contract were returned to the original owners, or mortgages on them were foreclosed by banks reluctant to assume control of such property. The situation during this period apparently was aggravated to some extent by the fact that a considerable fraction of the raisins produced were poor in quality. This of course did not help in winning favor for California raisins in the eastern markets where the consumption was relatively small. A change in the marketing system also complicated matters. In 1889, the packers had introduced the commission system under which they paid the growers a small advance when the raisins were delivered to the packing house, charged a fixed price for packing and selling, and paid the balance, if any, to the grower after the pack was sold.¹⁰⁸ The system did not meet with the approval of the growers, and naturally when the crash came in 1892, they attributed their difficulties to it. It is probable, however, that no marketing system contemplated at that time could have offset the rapid increase in production brought about by the boom.

Price Affected by the Seasonal Nature of the Crop.—Subsequently another difficulty, apparently inherent in the commission system of marketing as practiced by the raisin packers, was demonstrated. Under the plan then in vogue the price of raisins in a single season fluctuated greatly. The cause of these fluctuations was attributed, in part at least, to the competition among the numerous eastern agencies handling raisins. Their attempts to undersell one another resulted in extremely low and uncertain prices.¹⁰⁹ Such variations in price apparently were accompanied by considerable speculation. Whatever the cause may have been, the effect was deleterious to the progress of the industry. With a fluctuating price, wholesalers and retailers were unwilling to purchase in quantity lest they be forced to take a considerable loss on their purchases. The situation was aggravated by the distinctly seasonal nature of the crop and the single crop system employed by many of the growers. Practically all of the raisins become ready for packing within a period of from six weeks to two months in September and October. Consequently the growers, especially those with only one cash crop, always have been anxious to market their raisins early in the autumn. It is alleged that at times the packers capitalized on the seasonal nature of this single crop situation by withholding any large purchases until the growers, becoming alarmed at

¹⁰⁷ *Sun-Maid Herald*, Dec., 1917, p. 14; Jan., 1918, p. 6.

¹⁰⁸ *Ibid.*, Nov., 1917, p. 4.

¹⁰⁹ *Ibid.*, p. 6.

the slowness of the market, stampeded and sold for any price the packers offered.¹¹⁰

Early Coöperative Ventures.—The conditions prevailing in the marketing phase of the industry were recognized by many of the leading growers who urged that, if a sufficient number of the growers would organize to regulate the flow of raisins to the packing houses and to the eastern markets, conditions might be improved greatly. Consequently in the two decades following 1890 repeated attempts to organize the growers were made. These attempts revealed the problems involved in marketing the crop and the difficulties inherent in any plan of organizing the growers. From each attempt at organization something was learned, and gradually, by the slow process of practical experience, progress has been made in adapting the marketing aspect of the industry to the conditions on which it is based. Although local coöperative societies were formed in the raisin district as early as 1889, they handled only a small part of the crop and did not affect the general situation. It was not until the growers experienced the low prices of 1891, 1892, and 1893 that a widespread movement for coöperative marketing arose. In the earlier attempts at organization the plans involved the cooperation of the growers and the packers in the maintenance of prices. Thus in 1892, the California State Raisin Growers Association was formed. This organization included a majority of the growers and it perfected an agreement with the majority of the packers under which its members promised to deliver raisins only to these packers, provided the latter maintain a minimum price of 4½ cents a pound in the sweat box. However, packers not in the combine quoted prices to the eastern dealers below this minimum price, upon which the inside packers retaliated with still lower quotations. This practice so unsettled the market that the eastern dealers withheld purchases until the market broke, and, in the resultant scramble to sell, some of the raisins sold at a price which netted the growers 1¼ cents a pound in the sweat box.¹¹¹ Other attempts at organization followed. Apparently many of the packing concerns made earnest efforts at perfecting some sort of organization which would bring prosperity to the industry. Thus in 1894, the California Raisin Growers and Packers Company incorporated for such a purpose. However, being unable to secure the coöperation of a sufficient number of growers and packers, it failed.

Decline in Raisin Imports.—After 1894, the crop decreased con-

¹¹⁰ Ibid., Jan., 1918, p. 7.

¹¹¹ Ibid., Dec., 1917, p. 6.

siderably in acreage and amount, and conditions in the industry improved accordingly. Thus in 1896 the price paid to the growers ranged from 2 to 3 cents a pound. It is probable that the higher price reflected also the decline in importations of Mediterranean raisins which, as shown in the following table, accompanied the low prices prevailing during these years. This decline cannot be attributed to

TABLE II

TONNAGE OF RAISINS PRODUCED IN AND IMPORTED INTO THE UNITED STATES FOR SELECTED YEARS* (SHORT TONS)

Year	Raisins Produced	Raisins Imported
	Tons	Tons
1885.....	4,700	27,000
1890.....	19,000	18,500
1895.....	46,000	8,000
1898.....	40,000	3,300
1902.....	50,000	3,300

*Compiled from Husmann, Geo. C.: Grape, Raisin, and Wine Production in the United States, *Yearbook, Dept. of Agric.*, 1902, p. 415.

the tariff, for the tariff act of 1894 placed the duty at one and a half cents, which is the lowest in the history of the rates on this commodity.

Importance of Leadership in a Coöperative Organization.—Following the large crop and extremely low prices of 1897, the growers organized in 1898 the California Raisin Growers' Association.¹¹² This organization demonstrated the importance of leadership in a coöperative movement, for it was formed and for some years held together largely through the efforts and leadership of one of the principal vineyardists in the Fresno District. This man advocated a program many aspects of which he was unable to carry into effect. He urged that the crop be pooled in order to control the quality and the quantity offered for sale at any particular time. He pointed out the harm which had accrued to the industry by the practice of shipping damaged raisins to the eastern markets, and advised that the association buy or lease all the packing houses and thus make itself independent of the commercial packers. He directed attention to the need of increasing the demand for raisins in the East, and advocated an advertising campaign to accomplish this end. He maintained "that the public good takes precedence over all private interests" and urged that the powerful social force of public opinion, and even social ostracism, be employed against growers refusing to coöperate to the general good. He argued also that men of the highest ability and widest

¹¹² *Sun-Maid Herald*, Feb., 1918, p. 8.

experience be engaged to direct the affairs of the association, and that salaries necessary to secure such men be paid. Many of these issues were considered too radical at the time, but practically every one of them is incorporated in the program of the present coöperative organization. The association of 1898 secured control of a notable proportion (estimated at 85-90 per cent) of the raisin grape acreage and installed a system of grading and packing. For several years it maintained sufficient control of the movement of raisins to stabilize the market to some degree at least, and reasonable prices and prosperity resulted. Its subsequent failure is attributed to the unwillingness of the growers to vote the organization funds with which to acquire packing houses thus making it independent of the commercial packers. Furthermore, the packers in the combine carried their disputes into the courts, and the outside packers naturally lost no opportunity to discredit the association.¹¹³ Under these conditions it became impossible to keep some of the growers from breaking their contracts when the independent packers offered a fraction of a cent more than the association paid. Moreover at this time many of the growers viewed the sizable salaries paid the executives of the association with considerable suspicion. These things are not particularly surprising in view of the rather diverse nature of the social group and of the proverbial slowness of farmers to accept innovations which they do not fully understand. It took time and experience to bring a majority of the growers into a coöperative organization even when a common denominator characterized their economic interests. Therefore, in 1904, following a big carry-over from the preceding season, the association lost control of the crop and passed into the hands of a receiver.¹¹⁴

Producing and Marketing Aspects of the Industry Not Integrated.—In the ensuing years many companies, pools, combines, and plans of operation were advocated, and some of them were tried, but none of them were sufficiently comprehensive to correlate the producing and marketing phases of the industry. The situation was not unlike that of the individual railroads before they were welded into operating systems. The growers, packers, brokers, dealers, wholesalers, and retailers were separated not only by long distances, but, to some extent at least, by conflicting interests. To all of these, except the growers and possibly some of the packers, the raisin business constituted only a small fraction of their total interests. It is not far from the truth to state that interest in the raisin industry declined in direct proportion to the distance from Fresno. It took the growers many years to learn

¹¹³ Ibid., Mar., 1918, p. 9.

¹¹⁴ Husmann, Geo. C.: The Raisin Industry, U. S. Dept. Agric. Bull. No. 349, p. 4.

that an agricultural industry in most instances extends far beyond the limits of the producing region. They also had to learn and are still learning that if an industry is projected by the exigencies of its market into distant regions, it must become adjusted to the economic, social, political, and geographic conditions which maintain in those regions.

Conditions prevailing in the raisin country from 1904 to 1912 demonstrated that, while in a period of that length, an occasional prosperous year might be expected, such seasons were too few to establish the industry satisfactorily on a long-run basis. Thus 1905, 1906, and 1910 appear to have been fairly satisfactory seasons, while the other years were most unsatisfactory. In 1907 and 1908, for instance, prevailing prices fell to approximately one and three quarter cents a pound.¹¹⁵ Apparently the years in which the price of raisins more than covered the cost of producing the crop were those during or following a season in which the crop was short. Thus the short crop of 1910 was sold at a range from 2 to 2¾ cents in the sweat box. In September of that year rains followed by dew damaged the crop considerably. The relatively short crop of 1911 resulted from frosts in the spring and from unusually cool weather during the ripening season.¹¹⁶ However, poor seasons are few in the central raisin district, and production in increasing quantity was then and is now certain to follow satisfactory prices.

The conditions existing in the industry in the two decades preceding the formation of the California Associated Raisin Company in 1913 were summarized by the Federal Trade Commission in its investigation of the operations of that company in 1920 as follows:

"Prior to the organization of the Raisin Company, the raisin growers were virtually at the mercy of those engaged in the business of packing and selling raisins, and realized from their efforts a varying and uncertain return in the marketing of their crops. Those packers being in control of the purchasing power, secured to themselves the larger profit, while the grower frequently failed to realize the cost of production. Seeking to remedy this condition, the growers repeatedly attempted coöperative organizations, which failed largely because the form of the various organizations did not include adequate provision for finance and credit. Other devices were attempted without success, and, until the organization of the raisin company, the condition of the growers was, to say the least, unfortunate. Whether there was or was not a combination, or agreement without actual combination, among

¹¹⁵ *Sun-Maid Herald*, Apr., 1918, p. 7.

¹¹⁶ *Monthly Weather Review*, Sept., 1910, p. 1423; Sept., 1911, p. 1422.

the packers who were then the purchasers of the raw supply, is immaterial to this inquiry. The inequality of their situation forced the growers to enter the contest for control, at least so far as control was necessary, for the protection of their individual interests." This summary adequately expresses the conditions prevailing during the period in question. It does not, however, completely diagnose the situation, for it fails to recognize the fact that the several aspects of the industry needed to be integrated into a structure competent to serve the industry.

Importance of Geographic Surveys in a Coöperative Movement.—In 1911 the importance of statistical information and field surveys to a coöperative movement was demonstrated. In that year a raisin exchange was established at Fresno with the purpose of supplying the growers with information about all phases of the industry. Prices and sales were published in order to keep the growers informed of the trend of the market. It was argued that such records would disclose any widespread attempt of the packers to sell short and also the proportion of the crop remaining unsold.¹¹⁷ A bureau of statistics kept account of the acreage of all vineyards and the condition of the crop. In order to do this an agricultural survey of the raisin district was made. Maps were drawn covering the forty townships included in the raisin district. Every farm was plotted so that the acreage planted to the several varieties of raisin grapes, the ages of the vines, and the name of the grower were shown. While this exchange did not solve the marketing problem, it did prove of great value in organizing the successful association of 1913. For the first time, accurate information concerning the limits of each district in the raisin belt, the number of growers involved, the relation of the vineyards to the packing centers, and the concentration of the vineyards in certain localities became available. The work of the exchange undoubtedly helped in establishing a group consciousness which had been absent in previous attempts at organization. In addition, the leaders really knew when they had organized the 85 per cent of the growers which they realized was essential to a control of the crop.

Organization of a Successful Coöperative Association.—With the organization of the California Associated Raisin Company in 1913, the raisin industry entered a period during which the majority of the growers, through this company, have coöperated in the important business of marketing their product. This organization differed from its predecessors in that it endeavored to face the full range of marketing

¹¹⁷ *Sun-Maid Herald*, June, 1918, p. 6.

problems and thus led to an almost complete correlation of the packing and selling aspects of the industry. The company originally was organized with a capital stock of a million dollars owned and controlled by the growers in such a way as to eliminate speculation. This stock was to be held in trust for seven years by a board of twenty-five trustees elected by the growers. These trustees thus became the legal representatives of the subscribers with full power in conducting the company. This feature gave the company a measure of stability and power not enjoyed by the earlier organizations.¹¹⁸ The trustees elected a board of seven directors entrusted with the actual management of the business. The personnel of the original board illustrates how definitely the raisin industry is the leading economic activity of the district. It included in addition to three prominent vineyardists, an attorney, a leading banker, a merchant, and the manager of the San Joaquin Light and Power Corporation. By July of 1913, the company controlled by contract 94 per cent of the raisin acreage¹¹⁹ and possessed the power and the means to enforce these contracts. It also was able to purchase or lease a number of packing plants and to dominate the arrangements which it made with the commercial packers. It floated a loan with which to purchase the large hold-over from the 1912 crop. In August the directors named a minimum price for the 1913 crop. In the subsequent maintenance of this price the company was aided by the extent of their control of the crop, by the willingness of earlier wholesalers to take advantage of a stable price once they were convinced the company could maintain it, and by the relatively short crop of that season. The general opinion of the growers as to the success of their organization may be understood by a comparison of the prevailing price of $2\frac{1}{2}$ cents in 1912 with that of 1913 which ranged approximately from 5 cents to $6\frac{3}{4}$ cents through the several kinds and grades.

From the time a successful coöperative movement was launched in the raisin industry the organization has faced a series of perplexing problems. As a result, its functions have been enlarged, its form modified, and its name changed a number of times. Among the more important of these problems has been the creation of a sales organization capable of bringing the raisin district into a more efficient contact with the eastern and other markets, the promotion of sales of raisins by advertising in established markets and of discovering new markets, and a reorganization of the association to comply with federal laws.

A gradual acquisition of the functions formerly performed by the

¹¹⁸ *Ibid.*, July, 1918, p. 6.

¹¹⁹ *Ibid.*, Nov., p. 6.

packing companies featured the early activities of the California Associated Raisin Company. At the outset the company purchased or leased a few warehouses, a packing plant, and leased a seeding plant at Fresno. In addition they perfected an affiliation with the majority of the packing companies, under which the latter packed and sold raisins to the eastern dealers. Gradually, however, the association took over these functions by building or acquiring warehouses and packing plants and by establishing its own sales force in 1921. There appears to be no doubt that the company has succeeded in greatly improving the quality of the pack. It has done this by standardizing the work in the several packing houses and by building a large central seeding and packing plant at Fresno. In this plant, equipped with modern machinery, raisins are packed under model sanitary conditions. In addition, efforts have been made to improve the quality of the pack by urging the growers not to harvest their grapes before they are ripe. Previous to the establishment of the association, the packers placed an early time limit on the delivery of raisins to the packing houses.¹²⁰ This practice not infrequently led the growers to pick their grapes before they contained a sufficient amount of sugar to make good raisins. Therefore, to the extent to which this was done, advantage was not taken of the particular feature in the natural environment, i. e., the hot, dry, autumn, which constitutes the *raison d'être* of this industry in the San Joaquin Valley.

Increasing the Consumption of Raisins in the United States.—The prosperity accruing to the raisin industry after 1913 naturally led to an increased acreage and production of raisins. The directors of the growers' association faced this by inaugurating their well known advertising campaign. They created and widely advertised their "Sun-Maid" trade-mark, now evaluated at several millions of dollars and registered in 52 countries.¹²¹ This effective trade-mark in reality names a geographic relation, for it points to the particular regional asset capitalized by the industry. In establishing this trade-mark the association encountered opposition on the part of certain eastern jobbers because in doing it they practically eliminated the private carton business of these concerns.¹²² However, this procedure of the association appears justifiable because it was confronted with the distribution of a specialized product to a widespread market, and in doing this a trade-mark signifying a standardized product constitutes an important asset.

¹²⁰ *Sun-Maid Herald*, Apr., 1919, p. 4.

¹²¹ *Associated Grower*, Nov., 1922, p. 5.

¹²² *Sun-Maid Herald*, Feb., 1919, p. 4; *Journal of Commerce and Commercial Bulletin*, N. Y., Dec. 27, 1913.

In justifying an initial appropriation of \$100,000 for advertising purpose in 1914, the directors of the company pointed to the lower *per capita* consumption of raisins in the United States as compared with that of Great Britain and other representative countries.¹²³ In view of this fact, the company has advertised extensively. Some of their advertising has been designed to interest the support of the jobbers, brokers, and retailers selling raisins, but most of it has been planned to reach the consumers. To accomplish the latter, they have utilized space in magazines and journals having a national circulation and in newspapers commanding the attention of readers in the densely peopled industrial districts. The success of their early advertising campaigns led the company to organize a special advertising department and to appropriate \$2,500,000 for the campaign of 1922-23.¹²⁴ A few years ago the company caught the fancy of the country with its 5 cent package of seedless raisins, and sold 17,000 tons (\$18,000,000 worth) of them in this form in less than six months after this feature appeared on the market. The program to increase the use of raisins was aided to some extent by the emphasis placed upon their use as food during the war. At that time many people learned of the virtues of raisins as food, and others that California raisins were the equal if not the superior of imported fruit. In 1918, the importance of the growers' association in the industry was emphasized, because through its cooperation the war boards were able to carry into effect their program to divert shipment of Mediterranean raisins and other dried fruits, normally coming to the United States, to the use of the Allies, and at the same time to prevent an unprecedented rise in the price of raisins in this country.

Extension of Sales Organization to the Principal Trade Regions.—

In order to promote the sales of raisins the growers' association gradually expanded its sales division. Early in 1921 division sales offices were established in New York and Chicago, thus inaugurating the present widespread sales organization through which raisins are sold directly to the trade.¹²⁵ In order to facilitate sales, the United States is divided into 15 divisions. A district manager is maintained in each of the district headquarters, and resident salesmen care for the business in many other cities. The Canadian trade is handled through four divisional offices, and a personal representative is maintained in Mexico. Sales in the British Isles, where the consumption of Cali-

¹²³ *Sun-Maid Herald*, May, 1919, p. 5.

¹²⁴ *Associated Grower*, Aug., 1922, p. 6.

¹²⁵ *Associated Grower*, Jan., 1924, p. 10. Sales are made by the "Sunland Sales Association," a subsidiary of the growers' organization.

fornia raisins has become of considerable importance, are handled through divisional headquarters at London, Birmingham, Manchester, Glasgow, and in Ireland. On the continent, company salesmen operate in Belgium, Holland, Sweden, Norway, and Denmark. In the Orient, where district offices are located at Kobe and Shanghai, sales of California raisins are increasing. If the consumption of raisins can be promoted under the social and economic conditions which characterize the trade regions of Eastern Asia, those markets should prove an outlet for California raisins, because no other present or potential raisin district is as geographically related to them as is California. Sales headquarters in Singapore and Calcutta command the Indian Ocean trade regions. In addition, the company is represented in several of the South American trade regions and has commercial contacts of some sort in Australia, New Zealand, and elsewhere. It is surprising to realize that such a far-flung commercial organization, claimed to be the "most comprehensive distributive organization engaged in disposing of a specialized product,"¹²⁶ should have been developed in a single decade by a group of American vineyardists for the disposal of their product.

Principal American Markets for California Raisins.—Although the exports of California raisins have developed rather rapidly in the last decade, most of the raisins produced in California are consumed in the United States. While no figures are available to show the exact distribution within the United States, there is little question that the majority of the pack is consumed in the northeastern fourth of the country. The farming communities and industrial cities of the Middle West, and particularly the industrial and commercial cities of the eastern seaboard, constitute the areas to which a large fraction of the product moves. New York and Chicago are the principal distributing centers. From the American markets the rise of the California raisin industry practically has eliminated other raisins. In 1923 less than 5,000 short tons of raisins were imported, while in each of the preceding two years the amount was approximately 8,500 tons. Practically all of these were imported through the port of New York from the raisin districts of Spain, Greece, and Greece and Turkey in Asia. A large part of these imports is consumed in and near New York City by immigrants from the Mediterranean Region. In competing for the industrial markets of the eastern seaboard, the Mediterranean raisins had (in 1924) the advantage of a going ocean rate from Greek ports and from Smyrna of approximately 45 to 49 cents per 100 pounds as against a domestic rail rate on raisins from Fresno to New

¹²⁶ Ibid.

York of \$1.65 per 100 pounds in minimum carload lots of 40,000 pounds.¹²⁷ On the other hand, the domestic "pack" has an advantage over Mediterranean raisins of an import duty of 2 cents a pound under the tariff act of 1922 now in effect.¹²⁸ In view of the necessary cost of the American transcontinental freight haul, it is not surprising to discover that the industry promptly took advantage of the opening of the Panama Canal. This is evidenced by the explanation made by the directors of the growers' association, when on December 22, 1914 they announced an increase of $\frac{1}{8}$ to $\frac{1}{4}$ cents a pound on raisins. They stated that "the trade would not be obliged to pay the difference, but that cheaper rates resulting from shipping West Coast goods through the Panama Canal made the increase possible without disturbing eastern trade circles."¹²⁹ Since that time shipments via the canal have continued. In 1924, an official of the growers' association wrote that a constantly increasing proportion of the crop is shipped through the Panama Canal.

Exports of California Raisins.—The considerable increase in the export of California raisins, portrayed in the following table III, is another evidence of the vigorous progress being made by this industry. During the five-year period from 1918 to 1922, inclusive, nearly 45

TABLE III

EXPORTS OF RAISINS FROM THE UNITED STATES TO ALL COUNTRIES AND TO LEADING COUNTRIES, IN 1913 AND FROM 1918 TO 1922, INCLUSIVE (SHORT TONS)*

	1913	1918	1919	1920	1921	1922
Total Exports United States....	14,060	26,329	55,041	26,656	16,484	46,945
Exports to Canada.....	9,041	15,905	19,597	15,753	10,813	14,723
Newfoundland.....	237	256	566	269	66	181
Mexico.....	323	420	540	376	405	516
England.....	801	5,846	22,120	6,395	2,315	19,829
Scotland.....	100	42	1,085	790	353	2,133
Norway.....	14	275	3,305	695	1	225
Denmark.....	407	10	2,284	50	36	822
Netherlands.....	63		382	67		2,681
Japan.....	111	110	875	657	1,067	2,012
China.....	28	88	137	124	47	341
New Zealand.....	2,044	2,441	1,376	679	936	1,886

*Compiled from Foreign Commerce and Navigation of the United States, 1921, pp. 441-2; 1922, pp. 217-18.

¹²⁷ Courtesy of the Bureau of Agricultural Economics of the Department of Agriculture, quoting the United States Shipping Board and the Interstate Commerce Commission.

¹²⁸ Courtesy of Legal Division, Tariff Commission.

¹²⁹ *Sun-Maid Herald*, June, 1919.

per cent of the total exports were to Canada, while approximately a third were to Great Britain. The importance of Canada in this trade is indicative of the position of that country in relation to California and eastern distributing centers, to the emphasis which the growers' association has placed upon sales in Canada, and to the fact that Canadian consumers may be reached through advertisements in the principal journals of the United States. The distribution of California raisins into the major divisions of Canada may be judged by the following table IV showing the exports of domestic raisins from the United States to Canada in 1922. This distribution corresponds

TABLE IV

THE EXPORTS OF DOMESTIC RAISINS FROM THE UNITED STATES TO THE MAJOR DIVISIONS OF CANADA IN 1922 IN SHORT TONS.*

Divisions	Tons
Maritime Provinces	1,600
Quebec and Ontario	8,600
Prairie Provinces	3,200
British Columbia and Yukon	1,400
Total Canada	14,800

*Compiled from Commerce and Navigation of the United States, 1922, p. 218.

fairly well with that of population in Canada. The large imports into Ontario and Quebec reflect the active market of the agricultural districts and the manufacturing and commercial cities of the St. Lawrence Lowlands. Probably, if facts were available, the distribution of raisins into the corresponding divisions of the United States would be in approximately the same proportion.

It is surprising to witness an invasion of the British and other time-honored markets of Mediterranean raisins by the California product. Furthermore, it is open to question whether or not California raisins can compete in a large way in those markets. The Mediterranean raisins have the advantage of a shorter and cheaper haul, the prestige of a century or more of business, and, in Britain at least, the backing of importers who long have been an important factor in the Mediterranean raisin trade. However, of the American exporters, the growers' association at least appears to be making a strong bid for the business. In 1923 it appropriated \$300,000 for advertising in Great Britain, and, as previously stated, it maintains its own sales force there. In any case the importation of California raisins in Britain has become of sufficient amount so that in the Board of Trade returns of 1923, raisins from the United States were no longer submerged in "all others."

Legal Problems Faced by This Inter-Regional Marketing Organization.—In the establishment of coöperative marketing in the raisin industry, the growers' association has encountered many legal difficulties. This is not surprising, for it was one of the pioneer organizations of its type, it rapidly has increased its functions, it sells in many foreign countries, and as it operates in every state in the union, it subjects itself to the regulations which surround interstate commerce. The major experience of the association came when the legality of its operation under the Sherman Anti-Trust Act was brought into question by the Department of Justice in 1920.

The dispute over the legality of the California Associated Raisin Company began shortly after its organization. The independent packers apparently were convinced that the operations of the company were illegal, while the legal staff of the company emphatically declared that the organization conformed to the state and federal statutes. From time to time, during the early years of the association, it was investigated informally by agents of the Department of Justice, and in 1919-20 that department requested the Federal Trade Commission to advise as to whether the association was "obtaining and maintaining more than fair and reasonable prices for its products," and to submit recommendations under which the company might readjust its activities to conform to the federal statutes. This investigation resulted, in part, from the unprecedented prices for raisins which began in 1919 and which culminated in an average wholesale price of approximately 21 cents a pound for carton seeded muscats during much of the season of 1920-21.¹³⁰ The commission, upon investigation, found that "the price fixed by the raisin company for the 1919 crop was in excess of a fair and reasonable price," and made numerous recommendations as to the reorganization of the company to comply with the federal statutes.¹³¹ The association contended that the prices asked for raisins were not excessive in view of the prevailing high prices for other dried fruits and of commodities in general, and that the prices would have been higher if the association had not been in existence. Moreover, they claimed that the price fixed by agreement with the war boards in 1918 had not returned a profit to the growers. It was also pointed out that the association already had complied with most of the recommendations of the commissions.¹³² Finally in September of 1920, a petition filed in the case of the United States v. California Associated Raisin Company in the District Court at Los

¹³⁰ *Associated Grower*, Oct., 1922. p. 11.

¹³¹ Report of the Federal Trade Commission, June 8, 1920.

¹³² *Associated Grower*, Sept., 1920, pp. 4, 5-46.

Angeles, charged the company with monopolizing and restraining the trade in raisins in violation of the Sherman Anti-Trust Act. It was alleged that the association by means of its contracts with the growers and by its control of most of the packing houses held a monopoly upon more than 80 per cent of the total annual production of raisins in the United States. It further was alleged that the association, by means of its monopoly, forced purchasers to accept contracts which enabled it to control the price and that at times it had exacted excessively high prices for them. The position of the association apparently was weakened by the facts that, as it was organized, non-growers held some of the capital stock of the company, and that the growers exercised little direct influence in directing the policies of the association. As a result, it was argued that the association was not in reality a coöperative organization. From a legal viewpoint this may or may not have been the case, but from that of the majority of the growers, if their viewpoint may be judged by their loyalty to the organization and by their appreciation of the stability which the association has injected into the industry, the association was and is truly coöperative in nature.

The case was continued for many months, during which the agricultural and commercial interests of the country became greatly interested in it. They realized that on the decision hinged future procedure in the marketing of agricultural commodities. Finally, in January of 1922, the case was terminated by the entry of a consent decree under which the association was enjoined from carrying out their existing contracts with the growers and from certain aspects of their marketing plan.¹³³ As a result, the form of association has been reorganized radically and probably its position in the industry strengthened. Perhaps a more important result of this case was the profound influence it exerted in creating sentiment for the passage of the Capper-Volstead Act through Congress. This important law authorizes and encourages the organization into marketing associations of individuals engaged in the production of agricultural products. It now remains for such groups to evolve a working organization which will fit the industry and the region in question. If this is done, there should result a more scientific adjustment of our agricultural industries to their natural and social environment, and thereby materially promote the national welfare.

¹³³ In the District Court of the United States for the Southern District of California, In Equity No. B-67.

